ELECTRICAL TIMES

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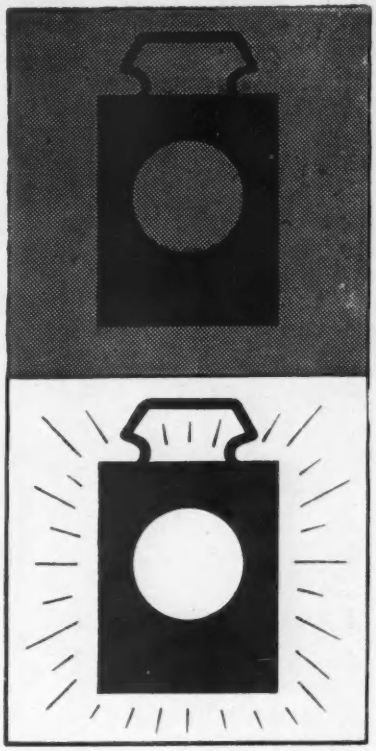

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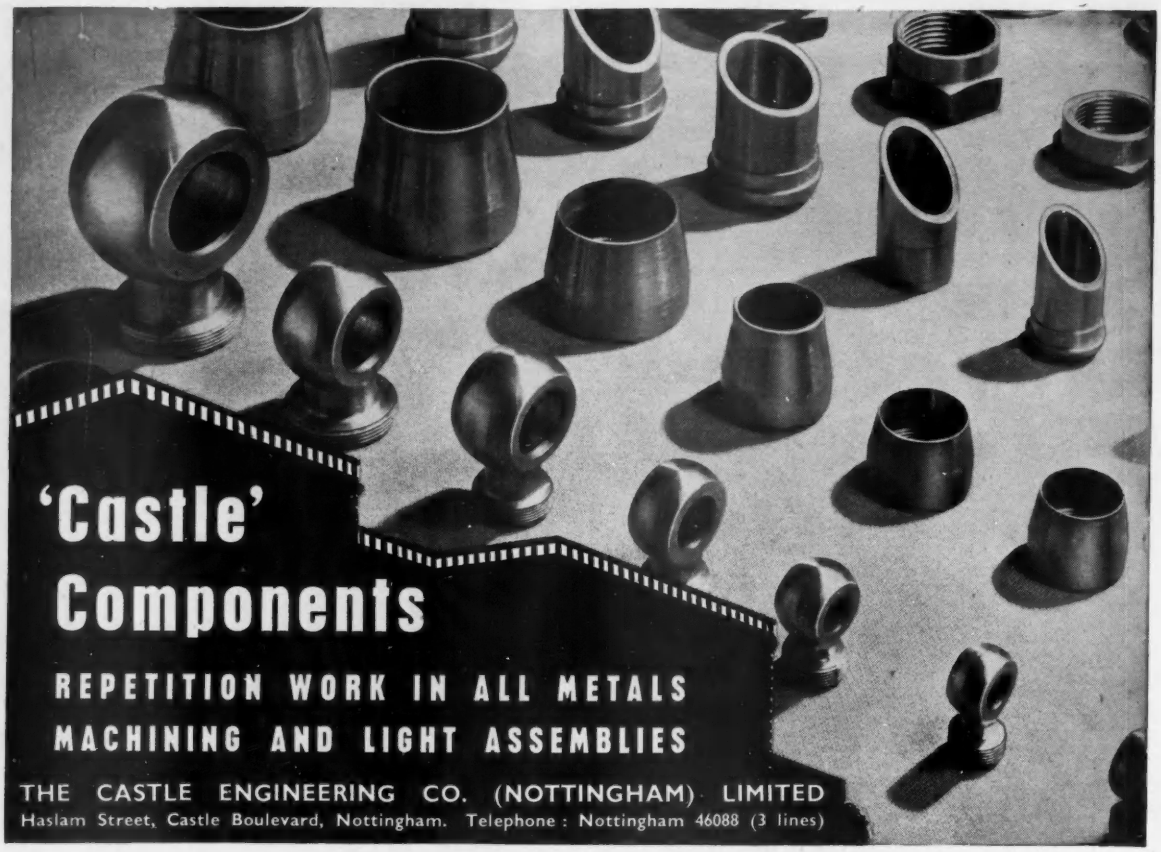

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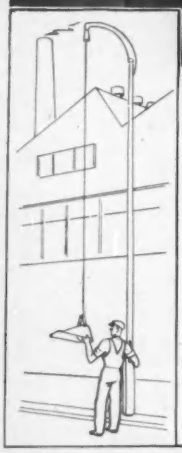

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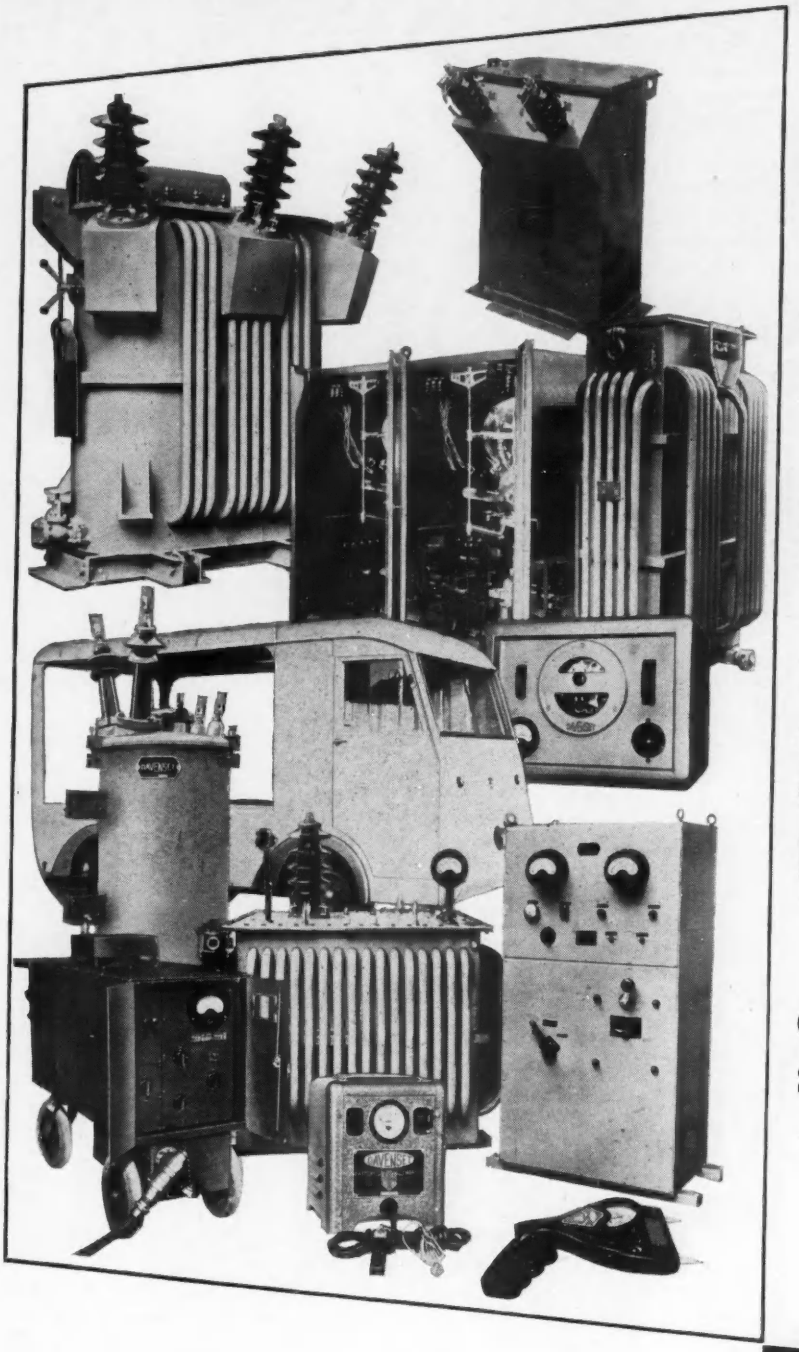

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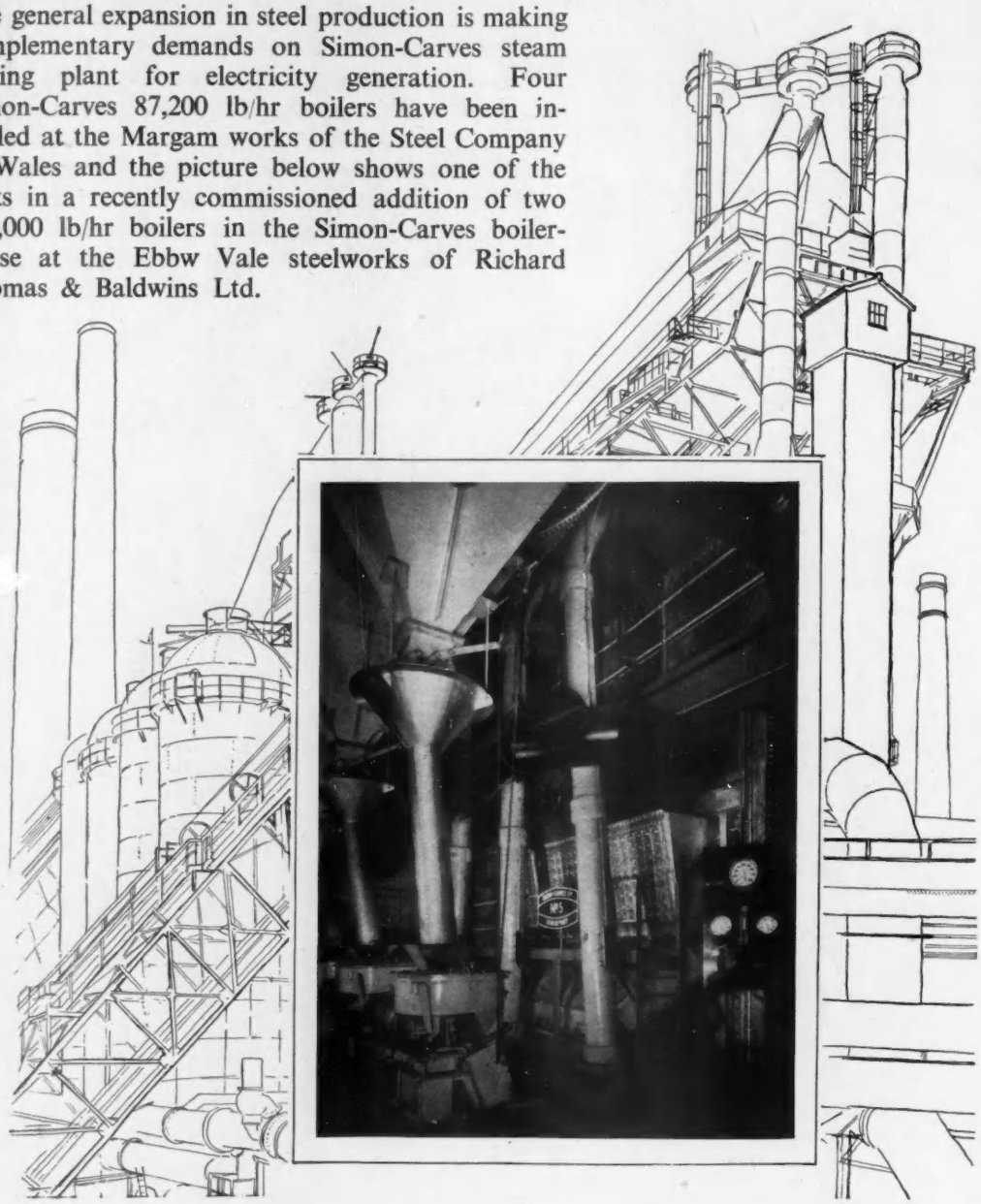

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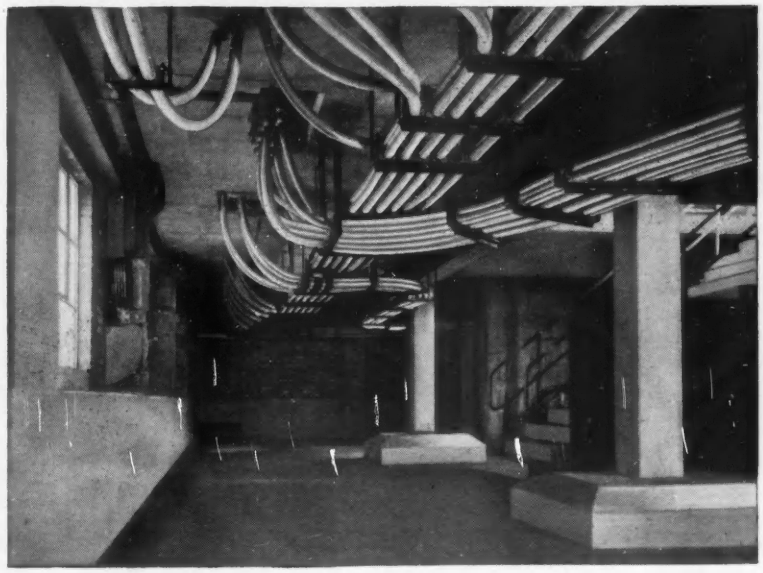

To facilitate increased production of beet sugar at the Kidderminster and Poppleton factories of the British Sugar Corporation Ltd., a complete re-planning of the L.T. power and lighting distribution schemes was recently undertaken. This work, involving the erection and jointing of some 4,000 yards of Ediswan paper-insulated mains cable in each factory, was designed and carried out by the Cable Contracts Department of The Edison Swan Electric Co. Ltd., in association with the Corporation's engineers.

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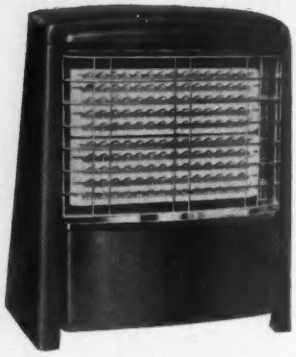

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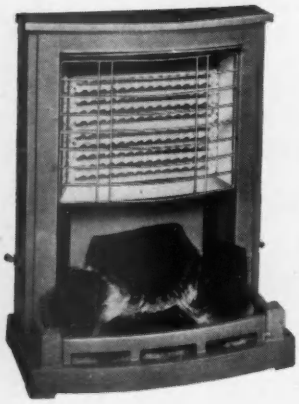

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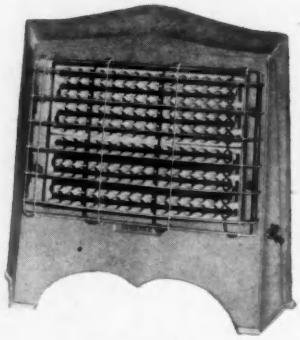

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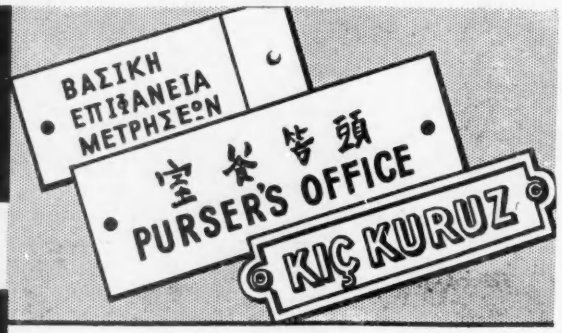

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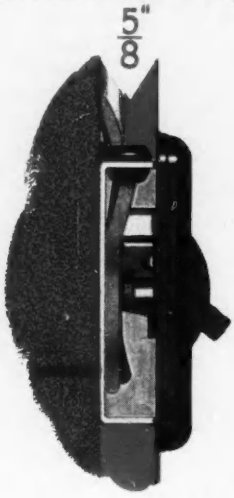
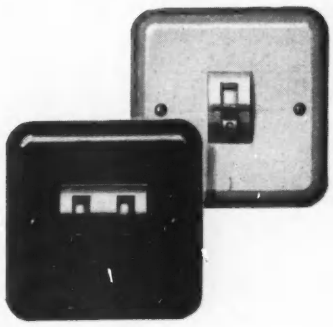


*See British Standard Code of Practice, CP 211 (1949) "The thickness of two-coat work exclusive of keys or dubbing out should be of the order of, but should not normally exceed $\frac{5}{8}$ in. . . ."



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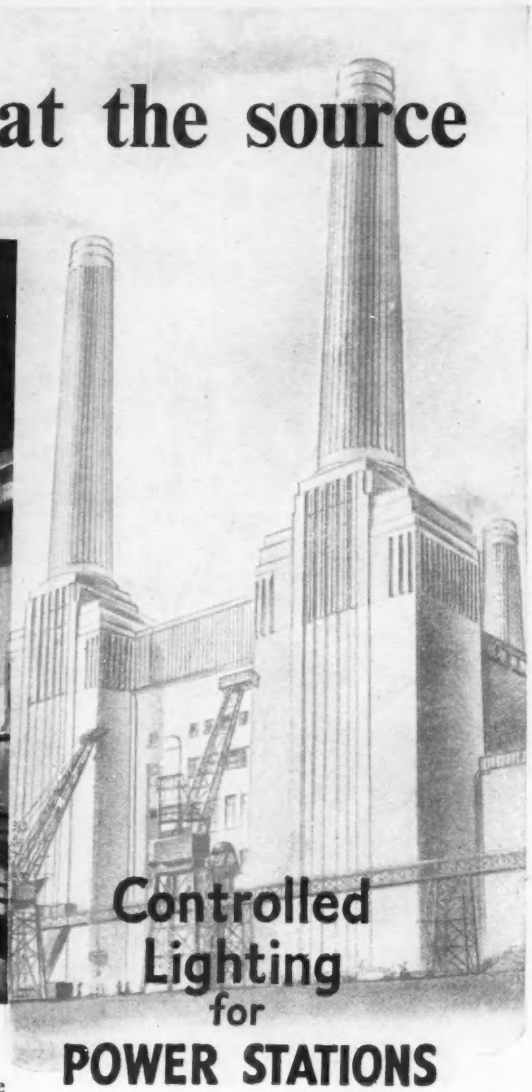

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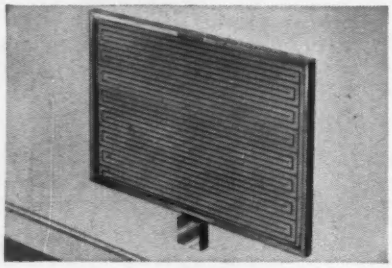

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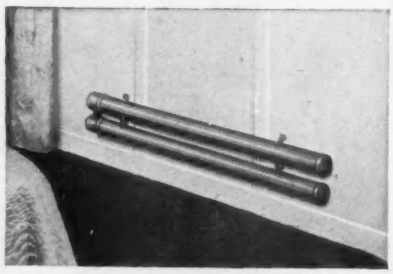

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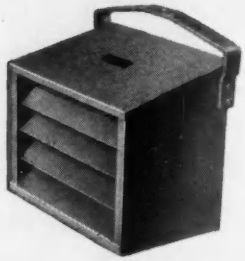

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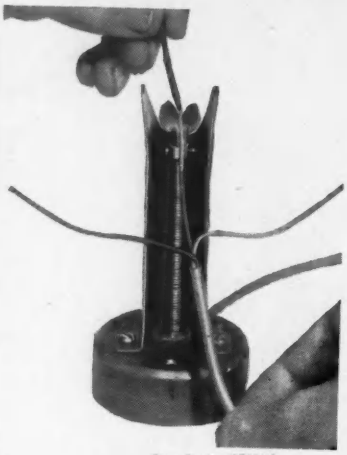

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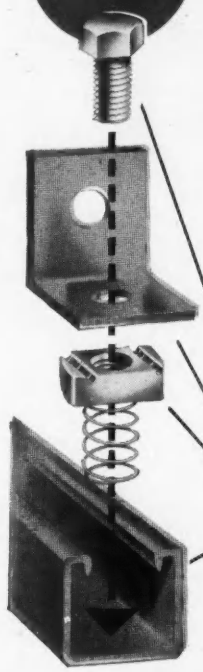

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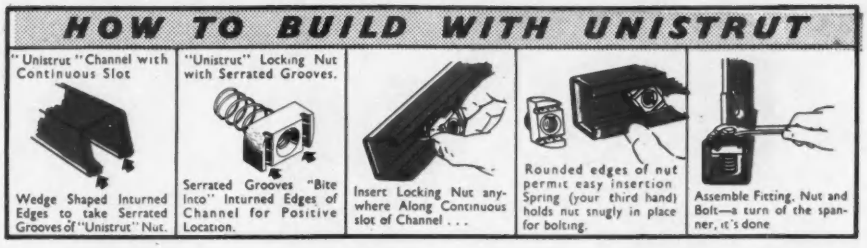
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"Unistrut" Locking Nut with Serrated Grooves.
Serrated Grooves "Bite Into" Inturned Edges of Channel for Positive Location.
Insert Locking Nut anywhere Along Continuous slot of Channel . . .
Rounded edges of nut permit easy insertion. Spring (your third hand) holds nut snugly in place for bolting.
Assemble Fitting, Nut and Bolt—a turn of the spanner, it's done

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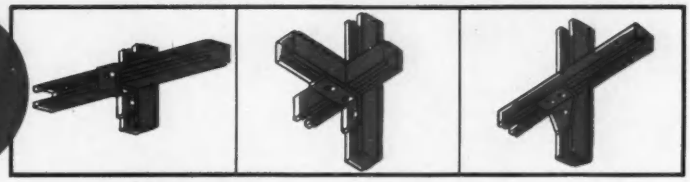
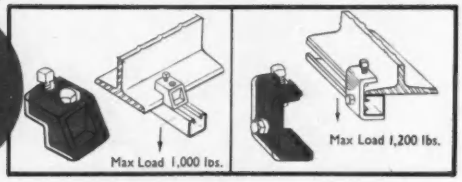


BEAM CLAMPS



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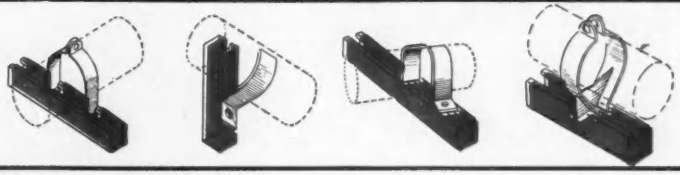
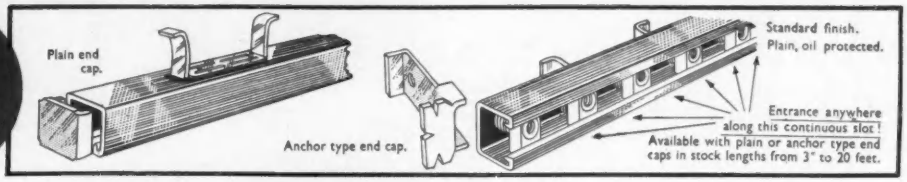


CONCRETE INSERTS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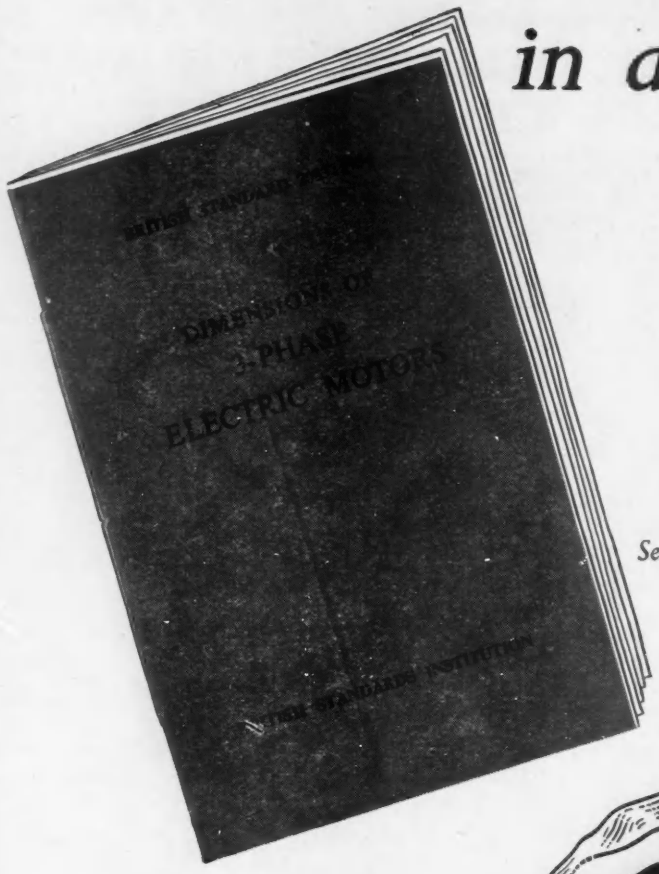

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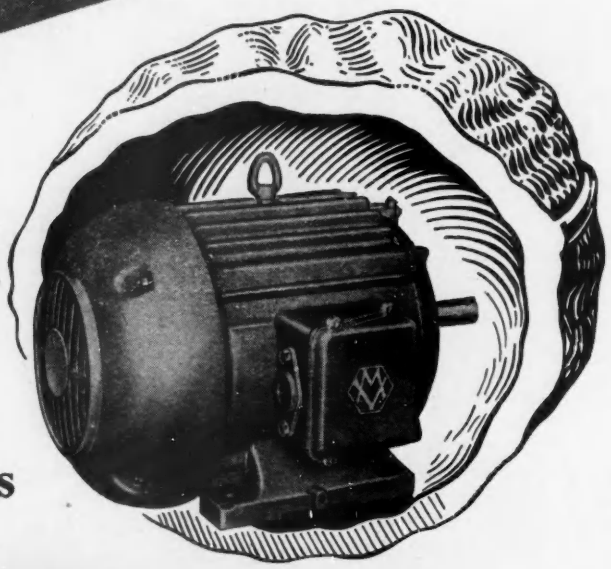

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MODEL TS

500H

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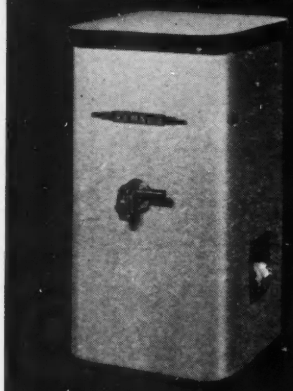

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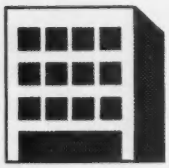
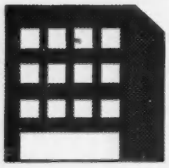


AUTOMATIC LIGHTING CONTROL UNIT MARK XV. This unit is for interior lighting and provides a finer degree of control. Widely used in factories, offices, schools, hospitals, etc.



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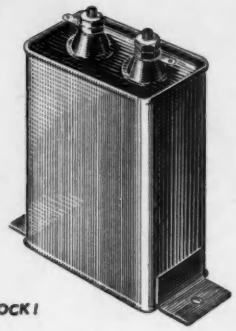

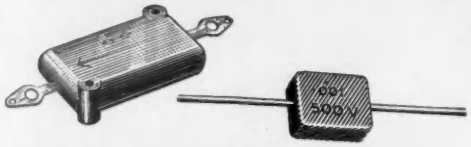

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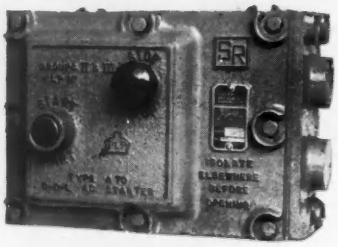

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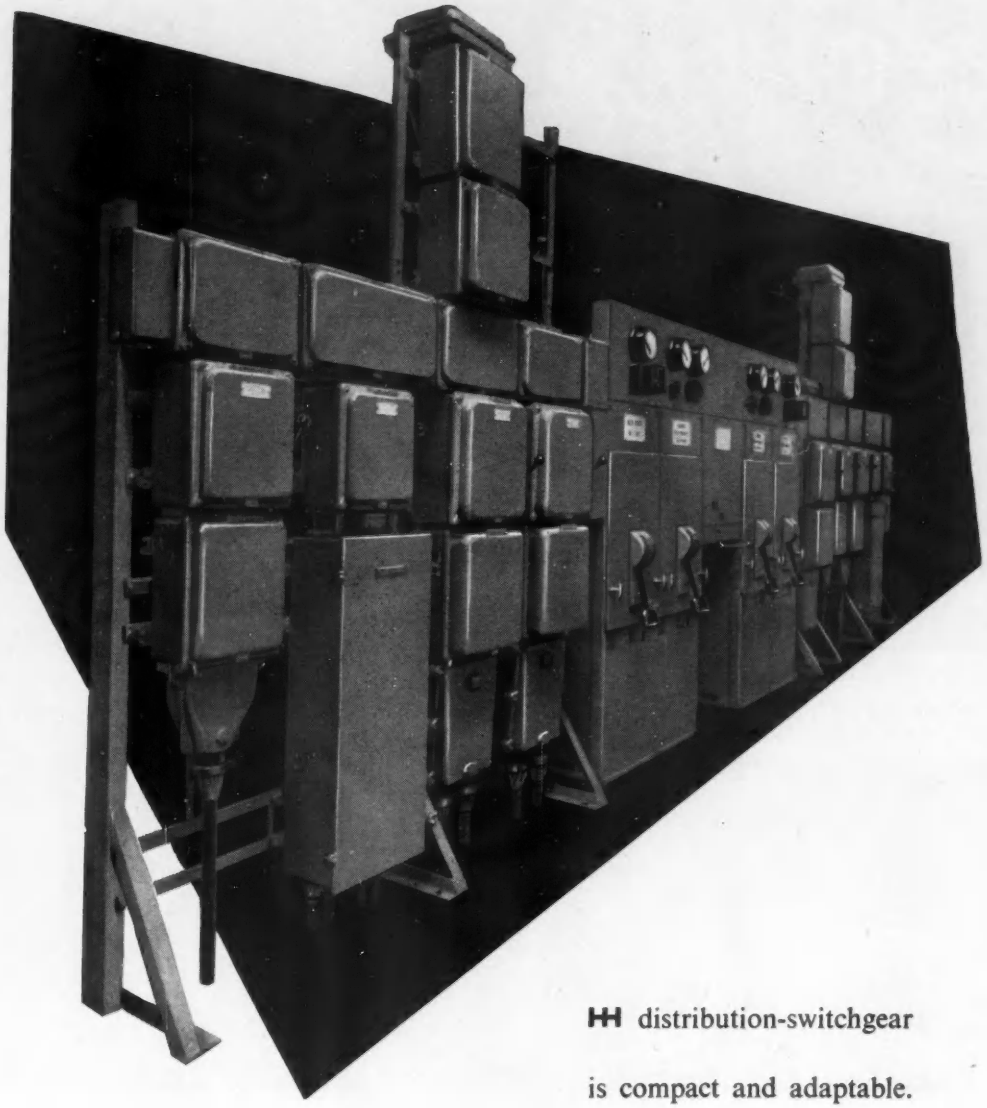

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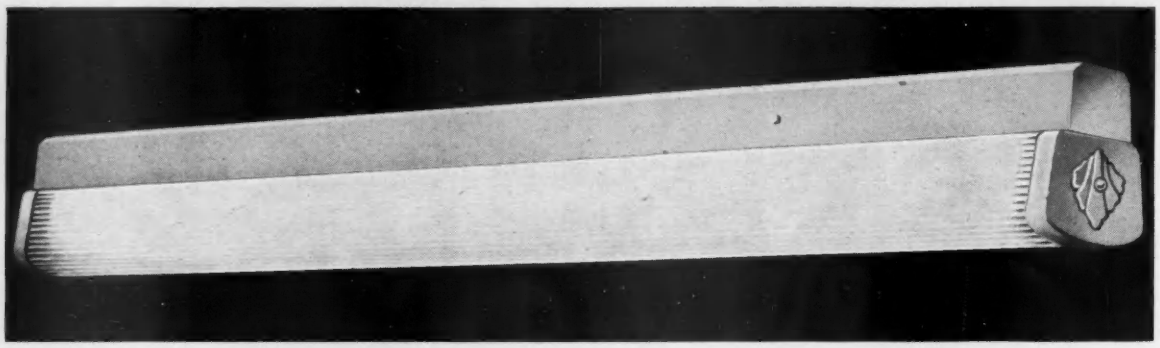

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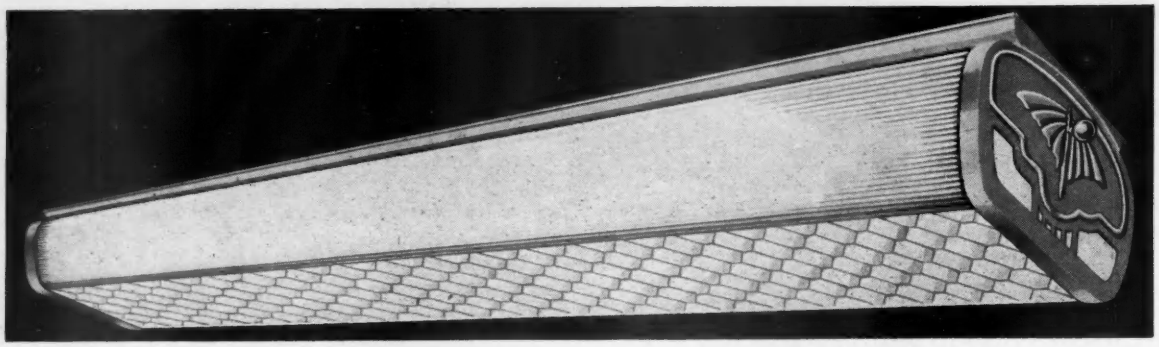

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EL5

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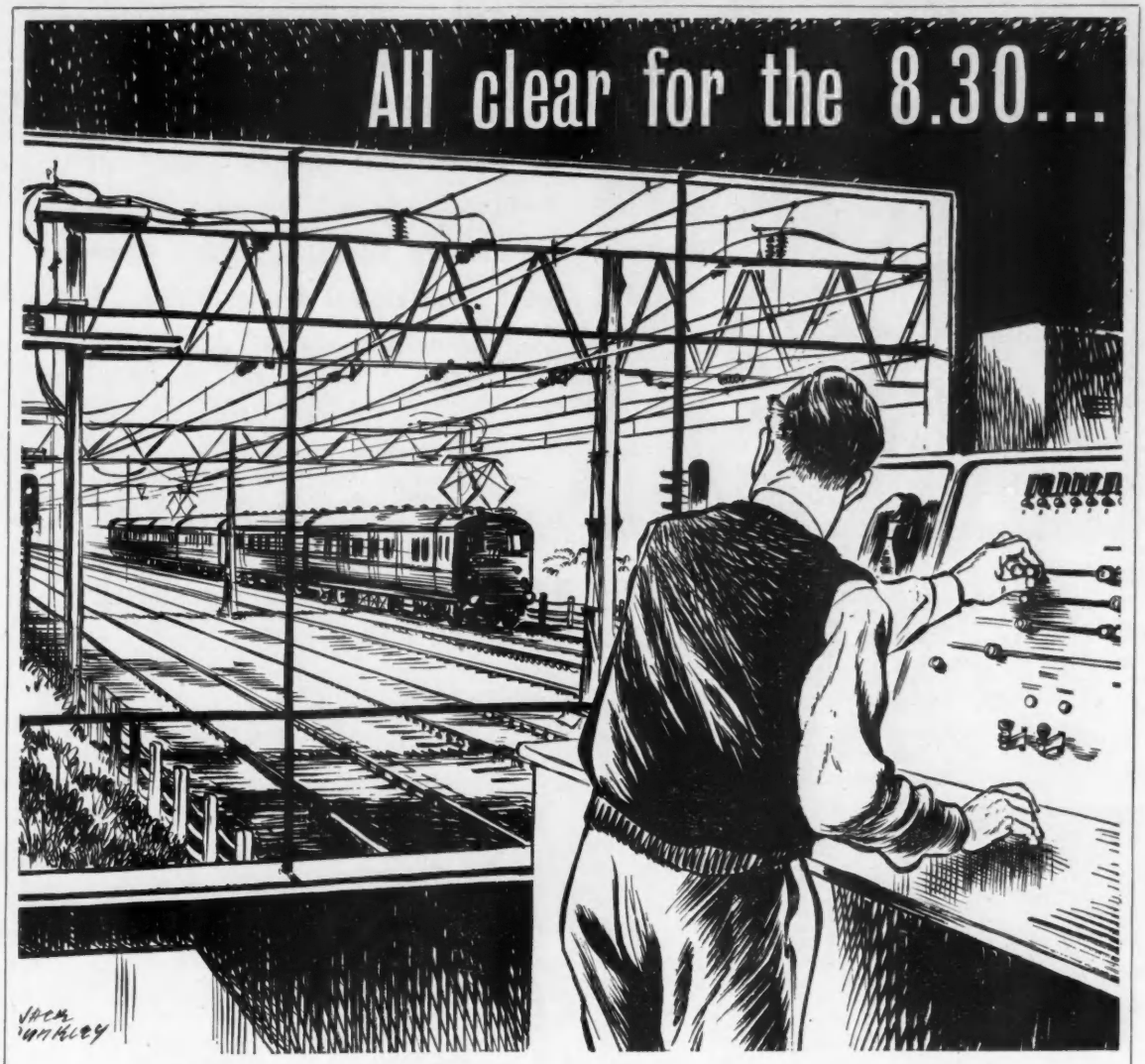

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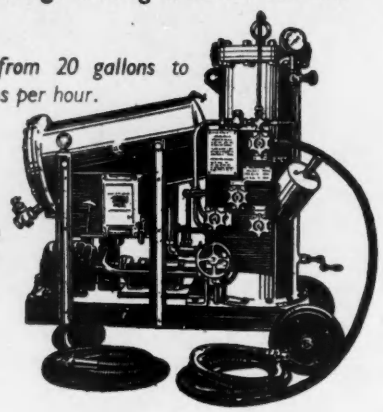

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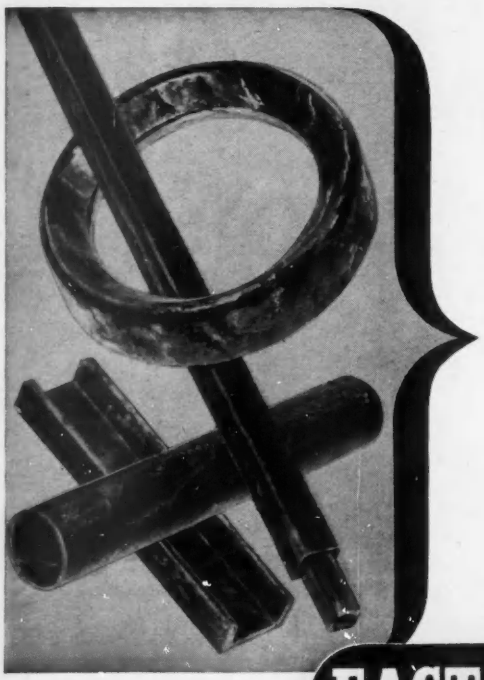

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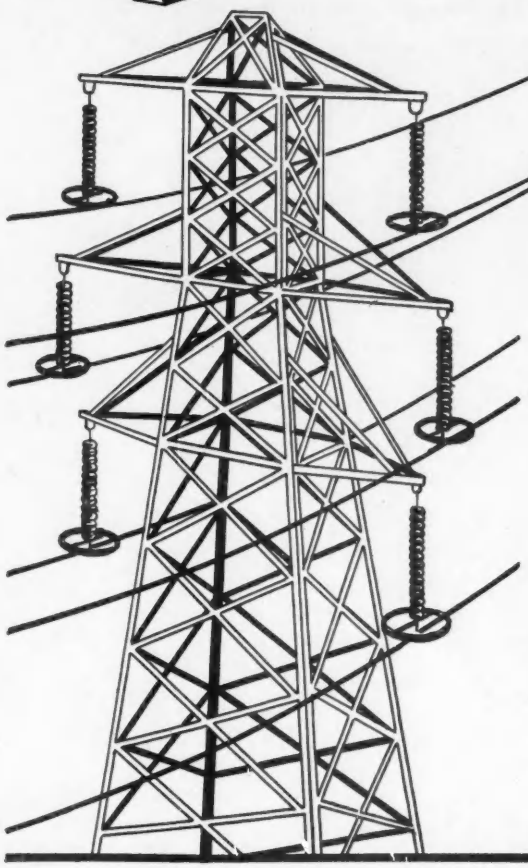

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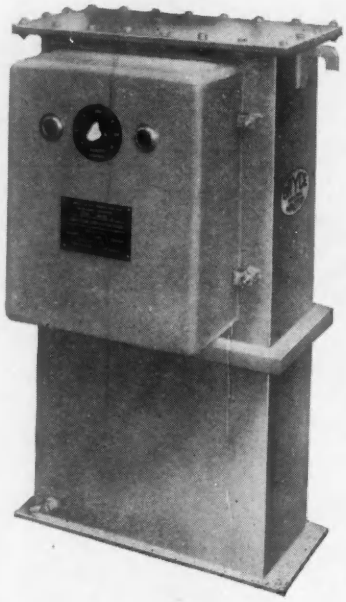

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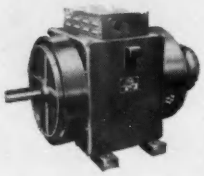

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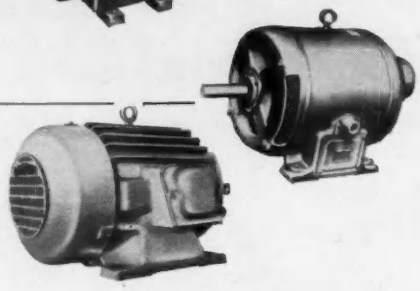

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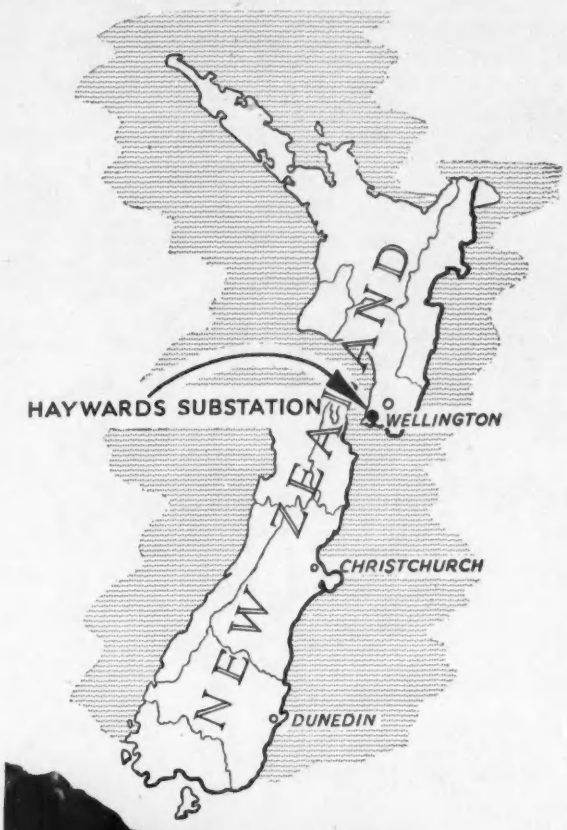

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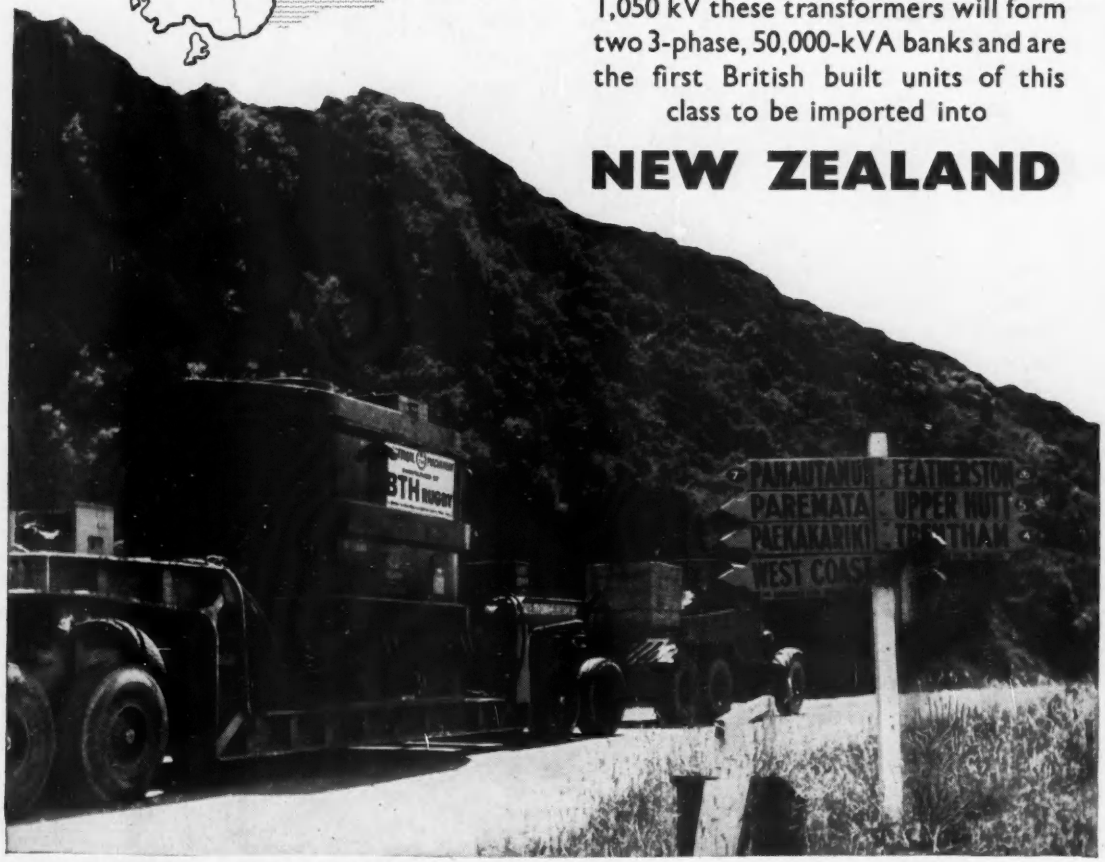

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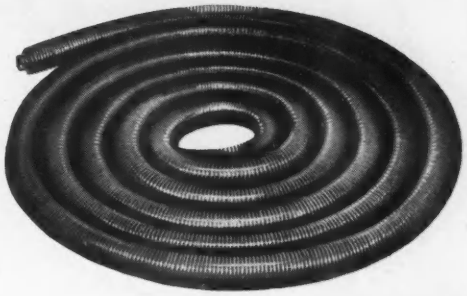

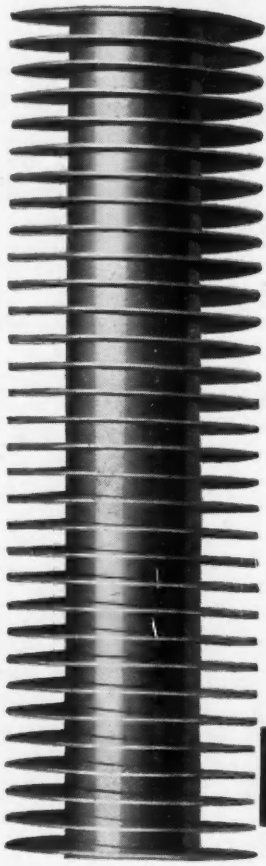

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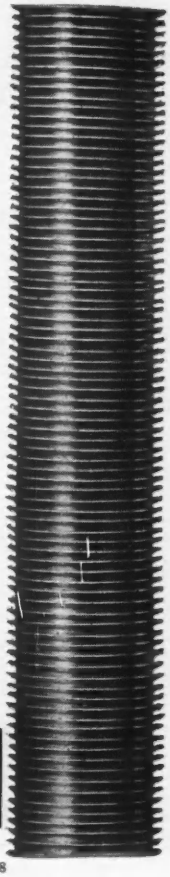

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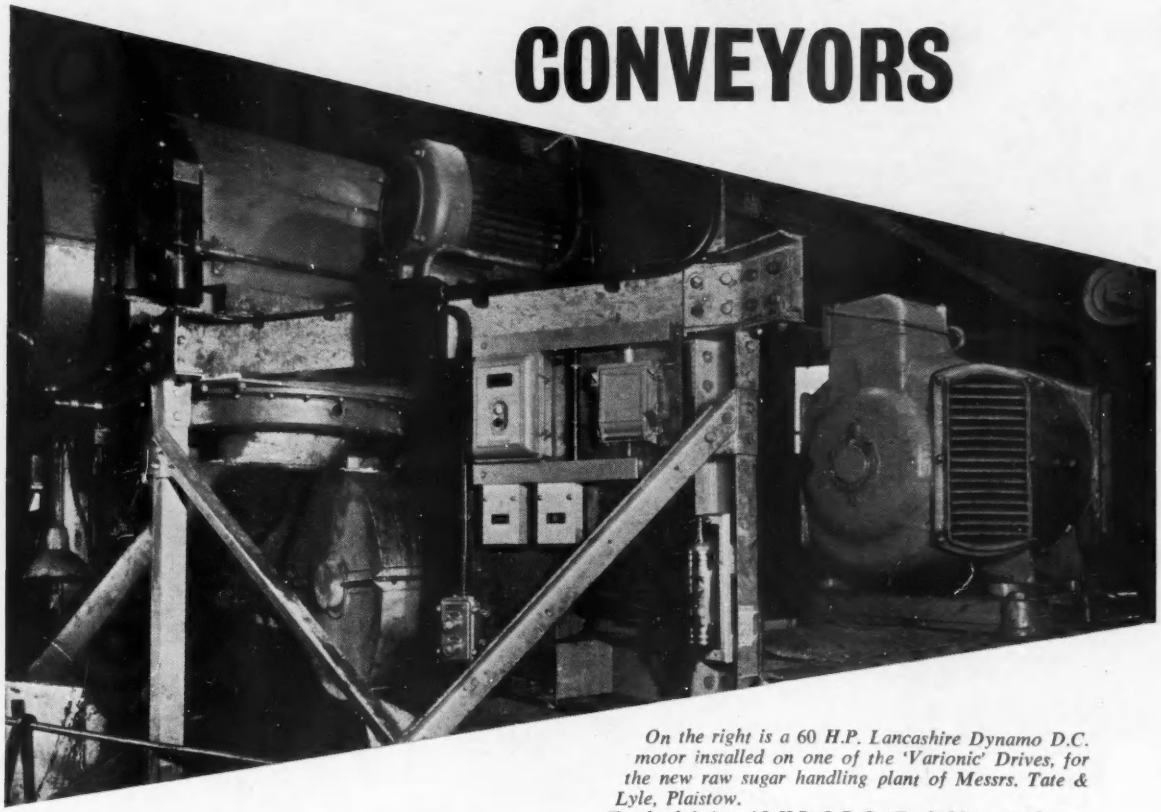

On the right is a 60 H.P. Lancashire Dynamo D.C. motor installed on one of the 'Varionic' Drives, for the new raw sugar handling plant of Messrs. Tate & Lyle, Plaistow.
To the left is a 15 H.P. L.D.C. 'Fankuld' squirrel cage motor driving a coal conveyor.

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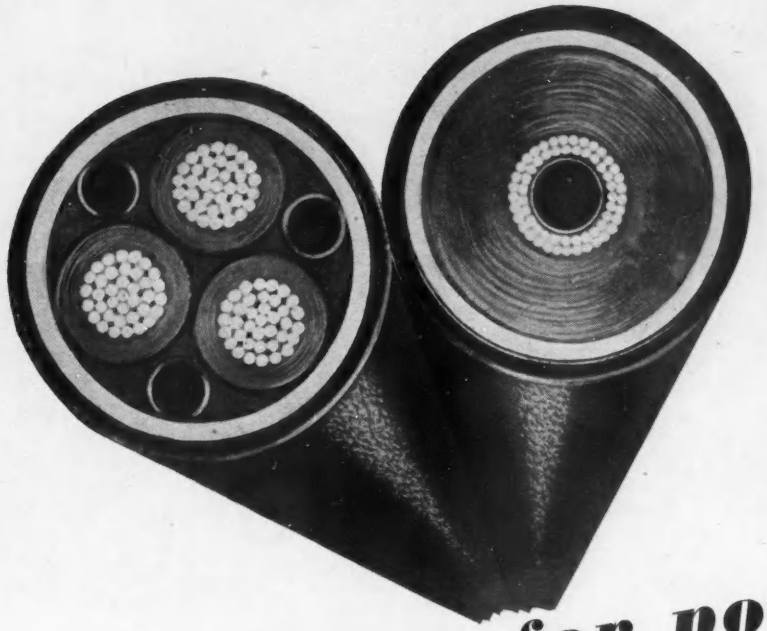
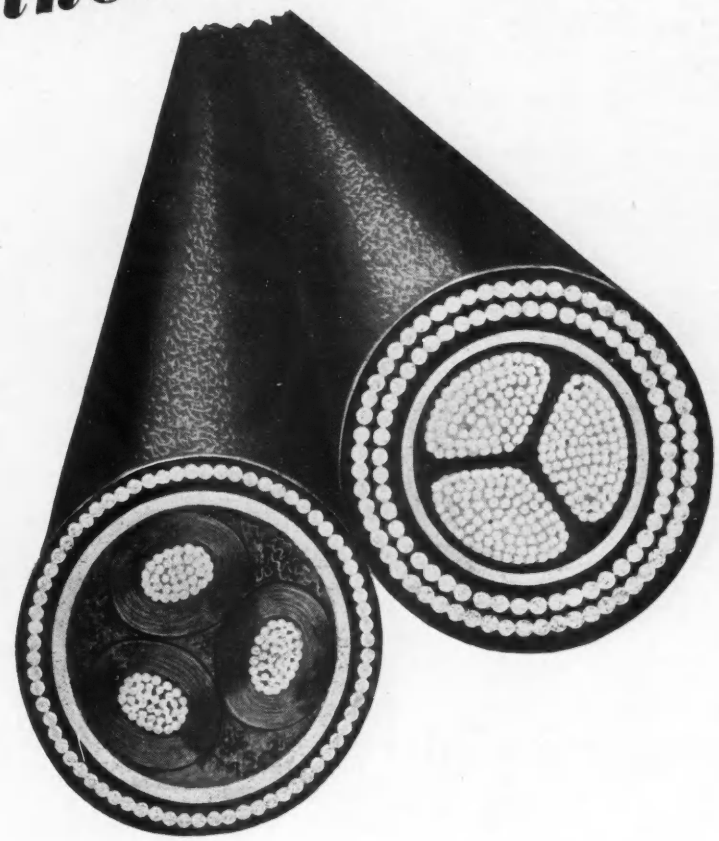


supply lines for power



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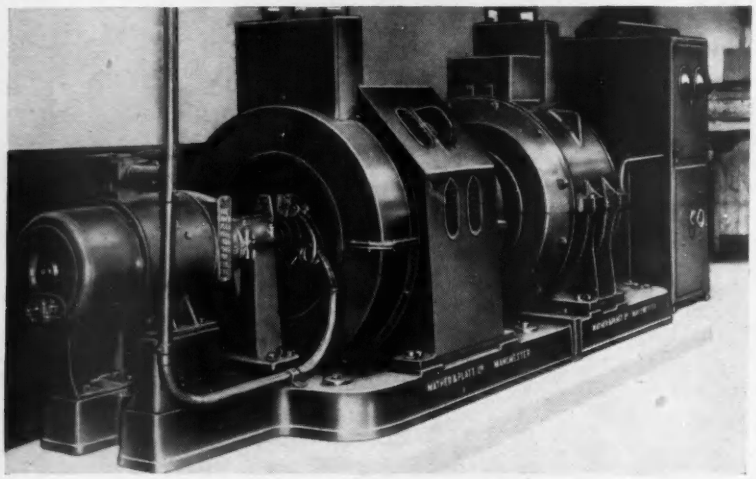

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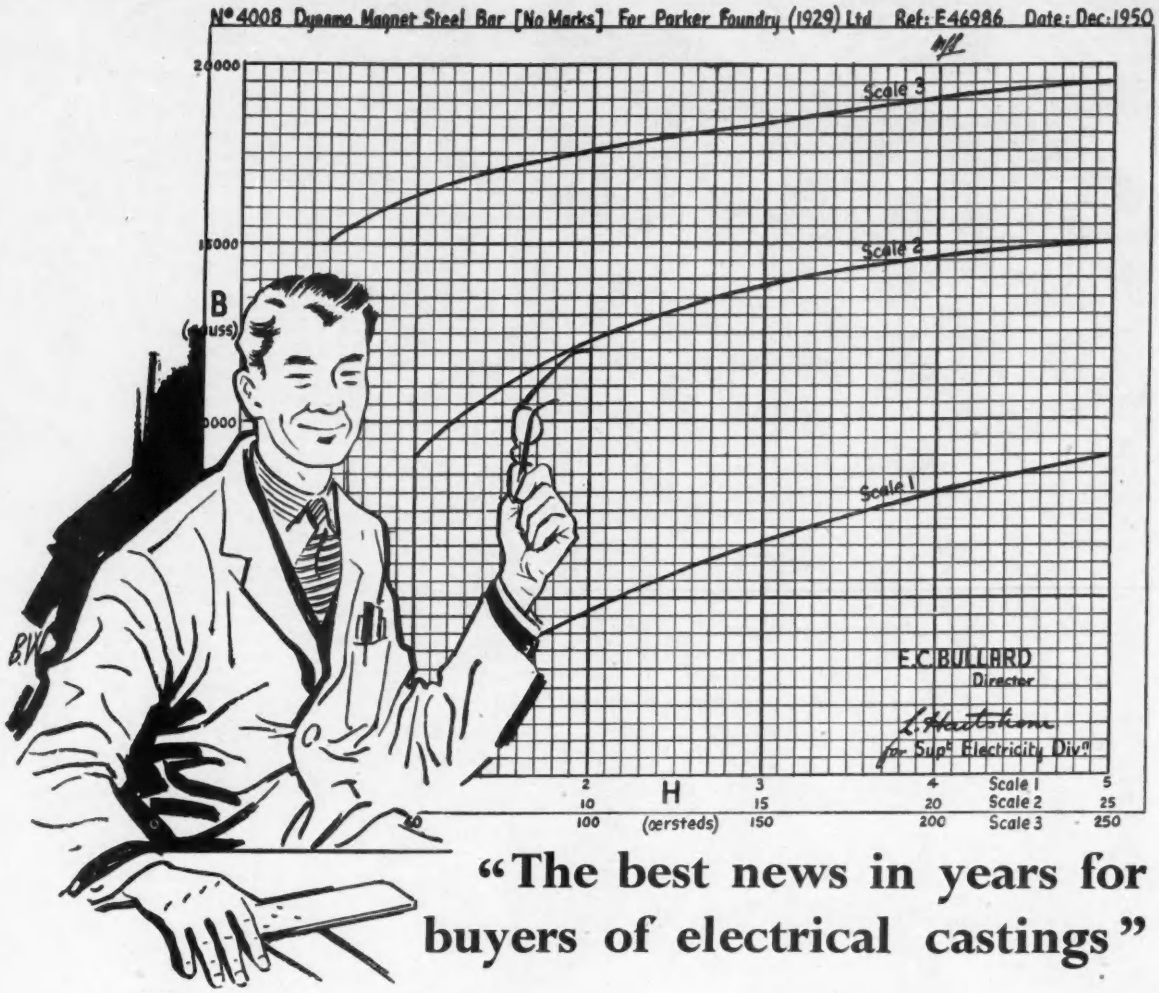

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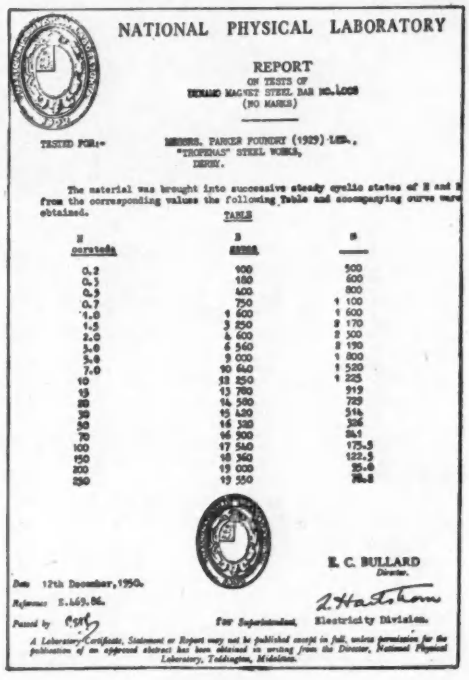

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H oersteds	B GAUSS.	B / H
0.2	100	500
0.3	180	600
0.5	400	800
0.7	750	1 100
1.0	1 600	1 600
1.5	3 250	2 170
2.0	4 600	2 300
3.0	6 560	2 190
4.0	9 000	2 800
5.0	10 640	2 128
6.0	13 250	2 225
10	13 780	919
15	14 580	729
20	15 430	514
25	16 280	326
30	16 900	84.1
100	17 540	175.5
150	18 360	122.5
200	19 000	95.0
250	19 550	78.2

E. C. BULLARD
Director.

Date 12th December, 1950.
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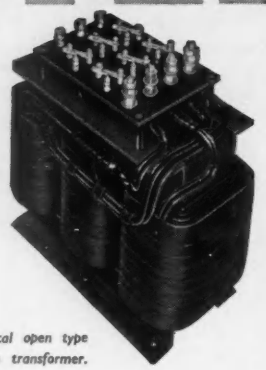

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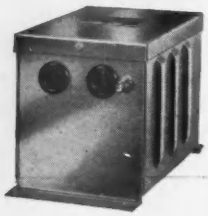

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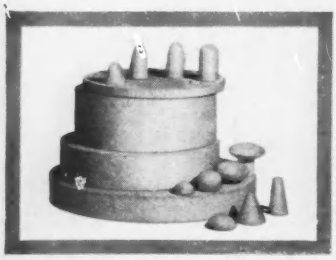

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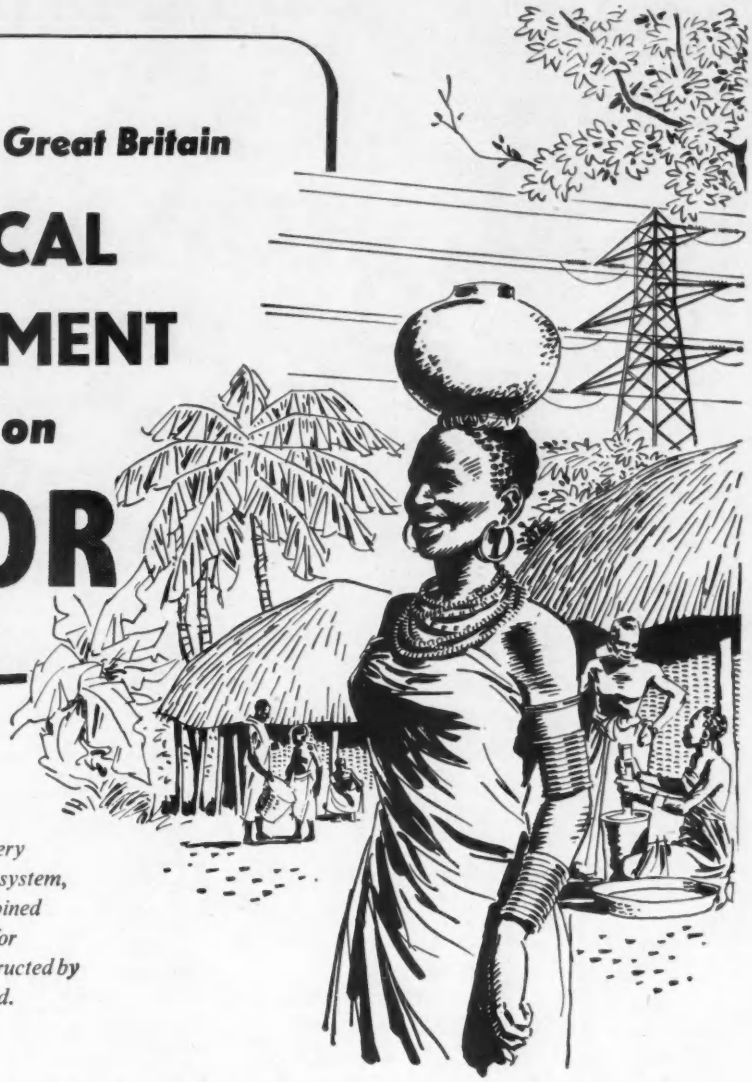

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SUBSCRIPTION RATES

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WHO PAYS FOR CLEAN AIR?

A national Clean Air Policy is proposed by the Committee on Air Pollution, whose final report published last week, makes a brave and comprehensive attack on a matter of undoubted public concern. Under the chairmanship of Sir Hugh Beaver, they have met resolutely the cardinal difficulty that the progress generally desired can be made only at considerable expense and at the cost of legislative interference with both personal and corporate preferences in fuel usage. In particular, electricity supply, the largest single user of coal, is exposed to the prospect of still heavier expenditure on flue gas washing equipment and on dust extraction plant, as well as to the inconvenience of an added body of inspectors to supervise its achievement in avoiding pollution. This will bear hardly on an industry which is generally admitted to have an excellent record as regards the fight with atmospheric pollution. Moreover, the drastic and costly flue gas washing techniques proposed by the Committee, even if they are the best method of tackling the sulphur dioxide problem—and this is admitted in the report to be questionable—will still reduce air pollution by sulphur compounds by no more than one-quarter of its present level. It is comparatively easy to suggest such possibly effective ways for the highly technical and conveniently centralised electricity supply industry to intensify still further its precautions against air pollution. It will be equally easy for the Government to demand that the appropriate action be taken. It may be tempting for the Government to do this as an immediate sop to public opinion, while shelving indefinitely the less convenient action called for against domestic fuel burners and industry generally. By this means the supply industry would be placed financially at a quite unfair disadvantage. It behoves its leaders to beware of this danger.

CLEAN BILL FOR HEATERS

One thing the electrical industry can be thankful for, the Beaver committee has given a clean bill of health to the electric fire. For too long has this convenient form of heating been subject to calumny as contrary to the national interest, even to the advocacy in some quarters for its prohibition. Now, on the contrary, electric heaters are shown as an essential part of any clean air policy the Government may adopt and under this newly acquired halo, the complete abolition of purchase tax is recommended not only from fires but from water heaters also. Unfortunately, the committee perpetuates some of the earlier comparisons in fuels which do not fairly present

the case for electricity, although those who take the trouble to read the footnotes will see the qualifications with which the figures are presented. Neither do the figures for solid fuel fully reflect the latest findings. However, the electrical industry must be content with this major step forward in official recognition. Whether the Government will implement this recognition is another matter. If the example of last year is to be followed when p.t. changes were announced in January there remains some two months, no more than time enough to reach a decision; one which is the more likely since Governments, as already remarked, have a habit of adopting the more easily implemented proposals of a report of this nature. However, with what looks to be an election budget on the horizon, a remission of tax of this order may be postponed until April and this is all the more reason for electrical interests to press for a decision early in the new year.

SAFETY IN STARTING

Many problems of operation and control of large turbo-alternators have arisen due to the trend toward greater unit capacities, allied to higher steam temperatures and pressures. Not the least of these has been that of ensuring safe but rapid starting. As long ago as 1941, work was in hand to develop instruments which could act as a guide to the turbine driver on the behaviour of the most critical part of his machine—the h.p. shaft—and this type of supervisory equipment has now amply proved its worth. As, however, emerged at the discussion last week on two I.E.E. papers dealing with recent developments, the two reasons for the installation of turbovisory equipment, safety and rapid starting, can prove mutually contradictory. The present limited application which gives a measure of the eccentricity and axial displacement at one part of the shaft alone, does not present a complete picture of the behaviour of the shaft as a whole. It is thus possible for other comparatively minor aberrations, such as temporarily locked flexible couplings, to provide an indication of serious eccentricity and thus halt what might otherwise have been a safe and rapid run up to speed. Although the equipment is therefore short of perfection, other speakers made it abundantly clear that from an economic viewpoint the additional cost is well justified for the protection of large machines, and particularly those which have to operate on two-shift working.

A USE FOR FLY-ASH

The disposal of ash and clinker from power stations has proved in the past a costly and difficult task, although a market has long existed for clinker for the manufacture of breeze blocks. This demand has been sufficient for one station, Nechells "B" to be equipped specially with chain grate stokers. With the large number of pulverised fuel boilers now going into commission, however, disposal of fly ash is a problem liable to increase in the future. It is only natural therefore that efforts should have been made both in this country and abroad to find some economic use for this finely divided ash which could, to some extent, offset the existing transport and disposal charges. That such efforts are meeting with a fair degree of success was shown at a recent B.E.A. exhibition of products in which fly-ash is used as a major constituent. Most of these utilise the ash in conjunction with cement for the manufacture of concrete aggregates, a task for which it is naturally suited. The main field, however, to judge from American experience, lies in the use of fly-ash as a constituent of mass concrete structures, where it possesses substantial advantages over more conventional materials, and leads to considerable savings in cement, with resistance to chemical attack and in some cases greater strength. While there still remains considerable work to be done particularly in the investigation of the properties of the differing types of ash which are produced by fuels from various pits, enough practical work is available to show that fly-ash has a useful function and that a part solution to the disposal problem is available.

PROGRESS IN AIR-BREAK SWITCHGEAR

It is noteworthy that in the recently issued A.S.T.A. rules for the short-circuit testing of air-break circuit-breakers, a Class "C" category is included which provides for ratings and operating duties equivalent to those of oil circuit-breakers (to B.S. 116-1952) up to 750 MVA, at 11 kV. While such switchgear in this country is generally limited to 3·3 kV, that the higher voltages have been included indicates that further development may be anticipated. The greater price of h.r.c. air-break gear as compared with oil circuit-breakers, has however, restricted its use to circumstances where the increased cost can be compensated either by decreased maintenance charges, or by acting as an insurance against the possibility of oil fires in the event of a switchgear failure. There is, nevertheless, a potential industrial market, as shown by American experience, and a narrowing of the price differential might result in a much wider demand for this gear.

CABLE TRADING UNCERTAINTIES

The report of the Monopolies Commission on Wires and Cables, published in 1952, made recommendations that struck at the roots of the trading organisation of one of the oldest sections of electrical industry. The end of 1954 sees preparations well advanced for putting into effect those recommendations, under the threat of direct Government action if they are ignored. On a later page this week there is given an outline of the graded discount scheme which will replace the present discount structure of C.M.A. members for rubber and plastic cables, with its exclusive trading and similar agreements. Later will come new minimum prices, and more complicated arrangements relating to mains cables. This is the most complete reorganisation yet enforced as a result of a Monopolies enquiry and we have previously expressed our doubt of its achieving in the long term the full effects of cheaper prices but unaffected quality which the Commission expected of it. Already, in the related field of paper cables, there have been suggestions that dangerous price-cutting is getting under way. Now that a stable structure worked out over many years has been so rudely demolished, none can say what the eventual outcome will be.

Meteor

Self-Regulating Alternators

THE VOLTAGE REGULATION PROBLEM AND SOME SOLUTIONS—PART 1

By J. GRIFFIN, A.M.I.E.E.

THE inherent voltage regulation of a conventional alternator at its rated load and power factor is usually defined as the voltage rise from full-load to no-load, with the exciting current maintained at its normal full-load value and the speed constant. Even in quite small machines this inherent regulation inevitably exceeds that of a d.c. generator, and it has long been recognised that it is neither practicable nor economic to construct machines of the conventional type with a regulation sufficiently close to eliminate the need for some form of automatic regulator.

For machines of medium and large outputs—say from 150-200 kVA upwards—the need for a separate a.v.r. (*automatic voltage regulator*) presents no serious technical or economic difficulty. Such machines are almost invariably housed in suitable buildings and can be properly attended and maintained, and the cost of an a.v.r. is but a small proportion of the total. For smaller machines the position is rather different; these may be installed in situations where skilled attention is not conveniently available but where reliability is essential, and with a small alternator the cost of an a.v.r. is a much larger proportion of the total. The rapid development during the last twenty years or so of the relatively small high-speed diesel engine has provided an almost ideal prime-mover for small generating sets, and the world demand for such sets has expanded enormously during this period. Obvious applications include generators for such isolated situations as farms, estates and plantations; for stand-by mains-failure insurance for emergency lighting and essential services in hospitals and factories; and as transportable sets for the services and for isolated civil engineering or similar constructional sites.

There are available for the voltage control of the smaller alternator various types of electro-mechanical automatic regulators, and the modern versions of these, in spite of their inherent reliance upon vibratory or rolling contacts or on resistance variation with contact pressure, are thoroughly reliable. They are relatively expensive, however, especially for the smaller machines, and some of them have a not entirely unmerited reputation for susceptibility to vibration, a factor which has, of course, to be borne particularly in mind in the design of self-contained and transportable engine-driven generating sets. These points, together with the fact that such defects as do occur usually call for skilled attention, have to some extent prejudiced certain users against the conventional a.v.r.; as a result various types of "self-regulating" alternator—in which the voltage change with load is much less than that of normal machines—have been developed.

There is no generally accepted or completely satisfactory definition of the term "self-regulating" alternator, and some of the machines so described by their manufacturers are basically normal alternators (albeit sometimes of unusual design or construction) fitted with unconventional but nevertheless external types of a.v.r. It is the purpose of this article to provide buyers and users of alternators with a general survey of the types of machine readily available in and from this country, and to this end all those designs achieving an abnormally close regulation without the use of an a.v.r. of the conventional electro-mechanical type are considered; it must be remembered, however, that only some of these are genuinely "self-regulating."

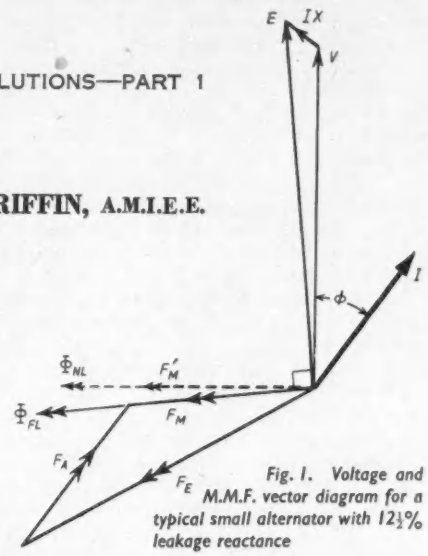


Fig. 1. Voltage and M.M.F. vector diagram for a typical small alternator with 12½% leakage reactance

The Problem

Before considering some of the various ingenious solutions to the problem of small alternator voltage regulation it may be useful to examine briefly the nature of the problem, i.e. to see just why the inherent regulation of a conventional alternator so greatly exceeds that of its d.c. equivalent.

In a d.c. shunt generator the voltage drop between no-load and full-load is accounted for by three main influences; these are (*a*) the armature circuit resistance drop, (*b*) the effect of the armature reaction on the useful flux, and (*c*) the exciting current change due to the terminal voltage change. In considering the corresponding alternator problem, the effect of exciting current changes is by definition excluded; the effect of armature resistance is negligible except in the very smallest machines, but there is the additional and more significant effect of armature leakage reactance to be considered; finally, the absence of a commutator and the effect of a lagging power factor load greatly increase the effect of the armature reaction.

LEAKAGE REACTANCE.—Some of the magnetic flux which would be produced by the alternating armature currents acting alone is *leakage flux*, i.e. flux which instead of crossing the air-gap links only with the armature conductors themselves. This leakage flux produces a back-e.m.f. of self-induction in the armature conductors, and for a given terminal voltage the dynamically induced e.m.f. (i.e. the e.m.f. produced by the relative motion between the armature conductors and the field system) must be increased accordingly. The self-induced back-e.m.f. is due principally to the slot and outhang leakage fluxes (although in actual operation only the latter has a separate existence, the slot flux existing as a distortion of the main flux), and it must

perforce be neutralised by a component of the dynamically induced e.m.f.; the neutralised back-e.m.f. is termed conventionally the leakage reactance drop.

Directly proportional to armature current, the leakage reactance drop is usually some 10 to 15% of the terminal voltage in a normal small machine, and it must be added vectorially to the terminal voltage to determine the total dynamically-induced or "internal" e.m.f.; this latter is thus some 6 to 10% greater than the terminal voltage at the standard power factor of 0·8 lagging. The voltage vector diagram for a typical machine with a leakage reactance of 12½% is shown in Fig. 1; the armature resistance, which would in practice be no more than 2%, has been ignored.

The increase with load of the internal e.m.f. naturally requires an increase in the useful flux and a corresponding increase in the magnetising m.m.f. (*magneto-motive force*). The full load magnetising m.m.f. F_M may therefore exceed the no-load figure F'_M by some 10 to 15%, depending on the leakage reactance, the degree of magnetic saturation, and any increase in field leakage flux with load.

ARMATURE REACTION.—The effect of the magneto-motive force set up by the load currents in the armature conductors is unfortunately not confined to the establishment of the armature leakage flux. There are in the machine two sets of current-carrying conductors; the *armature* conductors carry the *alternating* load currents, and the *field* conductors carry the *direct* exciting current. Assuming for the moment the rotating-field construction the exciting m.m.f. will be rotating with the rotor at the synchronous speed, and its space wave-shape may (to a first approximation) be considered sinusoidal*; the armature m.m.f. is normally very nearly sinusoidal and it rotates in space at the synchronous speed and in the same direction as the exciting m.m.f. There is thus no relative motion between the two m.m.f.'s, and they can interact to produce torque and transmit power across the air-gap. The flux-producing or magnetising m.m.f. acting radially across the air-gap at any point is, of course, the resultant m.m.f. produced by the interaction of the armature and the exciting m.m.f's; if these are sinusoidal then the resulting magnetising m.m.f. will also be sinusoidal, and the whole system can thus be considered in terms of the space vectors of the three m.m.f.'s.

*This is approximately true of the distributed-field construction, but is clearly inaccurate for a normal salient-pole machine; in practice, however, the effects of the discrepancy are purely secondary.

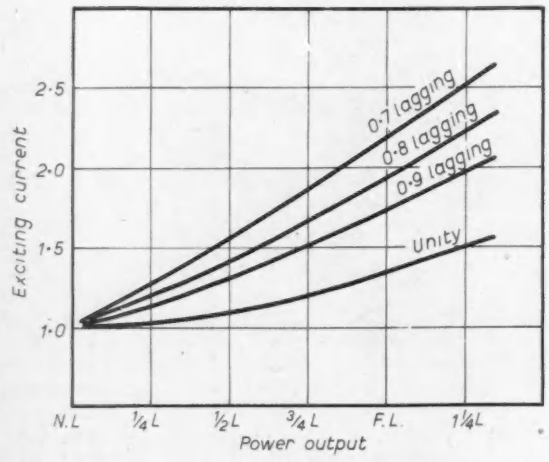


Fig. 2. Exciting current/power output characteristics for typical 75 kVA 4-pole alternator

The corresponding space vector diagram is shown in Fig. 1, in which it is supplementary to the voltage vectors already considered, and it will be clear from the diagram that the duty of the exciting m.m.f. F_E is to maintain the magnetising m.m.f. F_M against the reaction of the armature m.m.f F_A. The proportions of Fig. 1 are typical of a small conventional alternator of 50-100 kVA in which the three full-load m.m.f's F_E, F_A and F_M might be in the approximate ratios 2·0/1·0/1·1; the no-load magnetising m.m.f. F'_M for normal voltage on open circuit would in such a machine be about 1·0, and it will be clear that an unaltered exciting m.m.f. of 2·0 will produce a full-excitation open-circuit voltage considerably above normal. The actual voltage rise or regulation will depend not only on the m.m.f. but also on the design of the magnetic circuit, but for a typical machine of the output and proportions already mentioned the regulation would in practice be about 30 to 35%.

POWER FACTOR.—It can be seen from Fig. 1 that in any given machine the output power factor will greatly affect the magnitude of the exciting m.m.f. for a given power output. Both the magnitude and the space displacement of the armature reaction m.m.f. are dependent on the power factor, and the directly demagnetising component of the armature m.m.f. increases as the power factor becomes more lagging. The magnitude and phase of the leakage reactance drop are also affected; the internal e.m.f. increases as the power factor becomes more lagging, and corresponding increases in useful flux and magnetising m.m.f. become necessary.

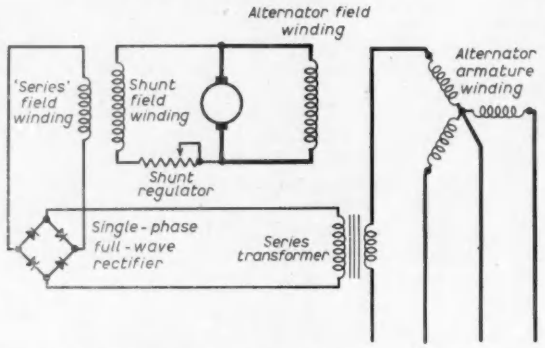


Fig. 3. Diagram of connections for line-current compounding

The exciting current/power output characteristics of a typical 75 kVA 4-pole machine at various power factors are shown in Fig. 2. The problem of so controlling the exciting current as to maintain the terminal voltage even approximately constant is clearly a much more difficult problem than in a similar d.c. generator; in the d.c. machine the effect of armature reaction (at least so far as main flux and voltage regulation are concerned) is one merely of a slight flux reduction due to uncompensated m.m.f distortion, and simple load-current compounding is an adequate solution for most normal applications.

DESIGN PROPORTIONS.—It is possible to reduce the inherent regulation of an alternator by the adoption of design proportions rather different from those already considered. By using a design in which the magnetic loading is high relative to the electric loading (their product being necessarily approximately constant for a given armature size), the effect of armature reaction can be to some extent reduced. Such a design, however, is inevitably uneconomic, since it results in a larger and less efficient machine, and in one much more sensitive to the effects of a lagging power factor load. Unless combined, therefore, with some form

of self-regulation, this re-proportioning of the loadings to give a magnetically "stiffer" design cannot in any case reduce the inherent regulation of any but the smallest machines sufficiently to make some additional regulator unnecessary.

As has already been explained, the cost and other disadvantages (real and apparent) of the conventional electromechanical a.v.r. have resulted in the development of alternative methods of control. It is proposed here to consider briefly the principles of operation of the types of machine either in common use or recently developed. It is impracticable to discuss these types in any completely logical order, since this order inevitably varies according to the point of view adopted; wherever possible, however, related types are considered as variations on a common theme or as logical developments of earlier machines.

Line Current Compounding

One fairly obvious method of voltage control, and one readily visualised by analogy with the ordinary compound d.c. generator, is to increase the alternator exciting m.m.f. with load by the addition to the field system of a winding carrying a current proportional to the load current. The direct application of this principle requires relatively large current transformers and rectifiers, but by utilising the amplifying characteristics of the exciter the size and cost of these components is greatly reduced.*

A separate "series" winding on the exciter is supplied from the d.c. side of a rectifier whose a.c. side is fed in its turn from a series or current transformer in the alternator output line (Fig. 3). A single-phase transformer suffices for the normal moderately-balanced load, and may be less expensive than the three-phase arrangement theoretically desirable for unbalanced loads. The shunt field is designed to produce from the exciter the exciting current required by the alternator for normal voltage on open-circuit, and a trimming regulator is included to provide adjustment for speed and temperature variations. When the alternator is supplying a load the additional excitation from the series winding, together with the consequently increased shunt winding m.m.f. increases the exciter output and thus maintains the alternator voltage.

This very simple method has been in restricted use for some twenty years, and for outputs of up to about 60 kVA and where an overall regulation of 5 to 10% is tolerable or where the load power factor is relatively constant there is much to be said in its favour; it is not expensive and since it is entirely static it is extremely reliable. Its most important defect is the absence of any sort of power factor discrimination; the series field current varies directly as the alternator line current, so that if the excitation increase with load is correct for some given power factor, it will be excessive or insufficient if the actual power factor is better or worse than the selected value. The increase in shunt field current with exciter voltage is also inconvenient and causes a "hump" in the alternator voltage/load curve; a rather better characteristic could be obtained if the shunt effect remained constant at its no-load value and the series contribution on load were correspondingly increased.

By judicious alternator and exciter design, however, and by the provision of tappings on the series transformer and a variable series field divertor to facilitate site adjustments to suit the actual nature of the load, a reasonably good performance can be obtained, and numbers of machines of this type in the output range 10 to 60 kVA are still giving satisfactory service in various parts of the world.

*The larger and costlier components may be justified if they eliminate the exciter; machines so designed will be described later.

†Marketed under the trade name of "Altoreg."

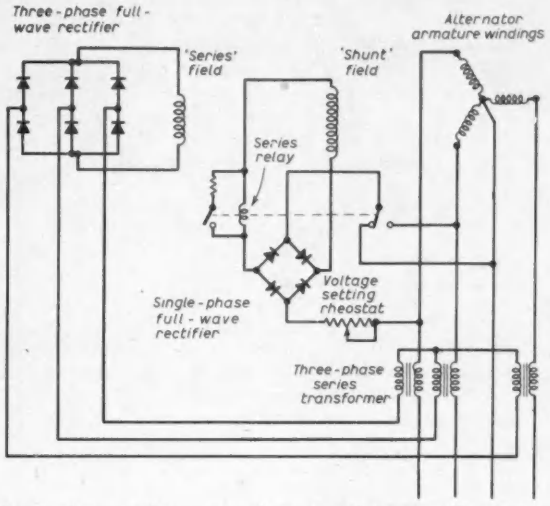


Fig. 4. Diagram of connections for compounded static self-excitation. Relay contacts shown in excited (operating) position

Compounded Static Self-Excitation

One of the deficiencies of the simple line-current-compounded alternator is overcome in a recently introduced machine† in which the whole of the excitation is provided by a completely static rectifier system; an approximately constant m.m.f. is provided by one field winding, and the series or current-dependent m.m.f. of a second winding provides the additional on-load excitation.

The basic connection schematic for this machine is shown in Fig. 4, from which it can be seen that the alternator is provided with two separate field windings, each of which is fed from a rectifier. The "shunt" or voltage-dependent winding is fed via a single-phase full-wave rectifier and a voltage-setting regulator from the alternator output terminals, while the "series" or current-dependent winding is excited by the rectified output of a three-phase series transformer in the alternator output lines.

By comparison with Fig. 3 it can be seen that the exciter has been eliminated, the whole of the excitation power being supplied by the alternator itself. Assuming for the moment that the alternator voltage does in fact remain approximately constant, the shunt winding will provide an m.m.f. corresponding to the no-load magnetising m.m.f.; one of the deficiencies of the machine with the line-current-compounded exciter—the increase with load of the exciter shunt winding m.m.f.—is thus overcome, and the non-linear exciter output/excitation characteristic is also eliminated.

The series m.m.f. is directly proportional to the output current, and by suitable design substantially constant voltage can be achieved at any one given power factor. Since, however, the on-load contribution of the series winding is independent of the load power factor, the combination is in no way phase discriminatory; as with the previously-described machine, therefore, the load compensation will be inadequate or excessive if the load power factor is worse or better than the value for which the excitation circuit has been adjusted.

As with the previous machine, however, an often acceptable regulation of 5 to 10% can be obtained by suitable design, and if the load power factor is relatively high or substantially constant some improvement on this performance is possible. Site or test-bed adjustment for load power factor or engine load-speed characteristics is again effected by means of series transformer secondary tappings, and the shunt field regulator provides voltage-level adjustment over a limited range.

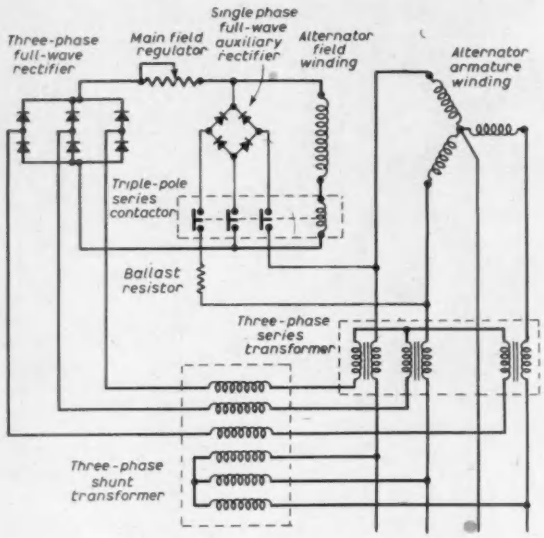


Fig. 5. Connections for phase-compensated static self-excitation

SELF-EXCITATION.—A small auxiliary relay, with its operating coil in the shunt field circuit, is employed to ensure that the open-circuit terminal voltage due to residual pole magnetism will initiate self-excitation, and it will be seen from Fig. 4 that the relay is arranged to re-connect the shunt field rectifier—normally coupled line-to-neutral—line-to-line when the machine is at a standstill. The residual voltage available for self-excitation is thus nearly doubled, and when sufficient field current is flowing to ensure complete build-up the relay operates to restore the normal line-to-neutral connection.* The parallel resistance controlled by the additional contact ensures that the relay action is completely positive and provides a simple and convenient operating current adjustment.

The elimination of the exciter and its replacement by the static exciting circuit provides a simple and reliable machine with a minimum of maintenance, and this feature should prove valuable for applications where skilled attention is difficult to arrange. This type of alternator is being offered for outputs of up to about 30 kVA, and its excellent transient response and high short-time overload capacity should make it very suitable for situations in which its comparatively wide regulation and the absence of power factor discrimination are of no great consequence; one example coming readily to mind is the provision of power for submersible pump motors.

One interesting technical refinement rather outside the scope of this article is the inclusion in the shunt field circuit (for special applications) of a small conventional a.v.r.; since the bulk of the excitation change with load is provided by the action of the series winding the duty of the a.v.r. is merely that of correcting quite small voltage variations, and the size and resistance range of the regulator are thus correspondingly reduced.

Phase-Compensated Static Self-Excitation

This device† is relatively modern, although technically it is a logical development of the simpler compounding device already described. It overcomes in an ingenious way both the main objections to the simpler device in that (*a*) it is "phase-discriminatory" and (*b*) its no-load excitation component (corresponding roughly to the magnetising m.m.f.) remains very nearly constant.

This alternator has no separate exciter or d.c. armature winding, and it is excited from a completely static rectifier system which includes both "shunt" (voltage sensitive) and "series" (current and phase sensitive) elements. The essential difference between this device and the simple compounding system lies in the combination of the two alternating components of the exciting current *before rectification;* the a.c. input to the rectifier is the *vector* sum of the two alternating components and the direct exciting current is thus rendered *phase-sensitive,* a refinement impossible unless the component combination is completed on the a.c. side.

The basic connection schematic is shown in Fig. 5. The alternator field winding is supplied from a rectifier whose a.c. side is fed from the series-coupled secondaries of two three-phase transformers; the primary of one—the "shunt" transformer—is connected across the alternator output terminals, and the primary of the other—the "series" transformer—is connected in the alternator output lines and carries the load current.

The output from the shunt transformer is directly proportional to the alternator terminal voltage, and the design is so arranged that this rectified output acting alone provides the direct exciting current necessary for normal voltage on open-circuit. (This excitation component thus corresponds to the *no-load* contribution of the shunt winding with the ordinary line-current compounding device.) The output from the series transformer is directly proportional to the load current, and it is this series component which provides the additional on-load excitation.

It can be seen from Fig. 5 that the a.c. input to the rectifier will be the vector sum of the outputs from the two transformer secondaries, and the corresponding voltage vector diagram (drawn for one phase only) for full load at unity power factor is shown in Fig. 6*a*. The reference vector V is the alternator phase voltage, the line current I being in phase with V; the secondary voltage V_{SH} of the shunt transformer is in phase opposition to V, while the secondary voltage V_{SE} of the series transformer lags by 90° on its primary current I. (Inherent ratio and phase angle errors in the transformers, and voltage drops in the rectifier, are neglected in this explanatory treatment; in practice these discrepancies can be predicted with reasonable accuracy and the necessary allowances made at the design stage.)

The design of the shunt transformer is such that the voltage V_{SH} is sufficient to circulate a direct exciting current corresponding to the alternator no-load magnetising m.m.f. F'_M (see Fig. 1), and the output voltage V_{SE} from the series transformer corresponds approximately to the effect of the armature reaction m.m.f. F_A; the resultant rectifier input voltage V_R then corresponds very closely to the exciting m.m.f. F_E required by the alternator for full power output at unity power factor, and the alternator terminal voltage thus remains sensibly constant.

The remainder of Fig. 6 shows the effect of changes in load and power factor, and these diagrams demonstrate very clearly the phase-discriminating property of the transformer combination. For convenience the value of the ratio V_R/V_{SH} (equivalent, neglecting ratio errors and voltage drops, to the ratio F_E/F'_M) has been noted beneath each diagram, and a glance at Fig. 2 will show how closely the exciting current/output relationship actually obtained approximates to that required for constant terminal voltage.

The regulation obtained in practice from machines of this type is less than 3%. Test-bed or site adjustment to suit the actual speed/load characteristic of the prime mover

*For single-phase machines the series field can be temporarily paralleled with the shunt field to the same end.

†Marketed under the trade name of "Stamford."

can be readily made (by altering an air-gap in the magnetic circuit of the series transformer), and the negative resistance/temperature characteristic of the rectifier provides a degree of compensation for the increase with temperature of the alternator field winding resistance. A series-connected main field regulator is provided to facilitate the initial setting of the voltage level required.

SELF-EXCITATION.—Once its terminal voltage has been established the alternator is "self-exciting" through the associated rectifier, the power for the field winding being generated by the machine itself. Owing, however, to the high "forward" resistance of the main rectifier, the machine is not *initially* self-exciting; the initial terminal voltage due to residual pole magnetism is insufficient—even with the alternator on open-circuit—to circulate enough exciting current to build up the terminal voltage to the normal value.

A small full-wave single-phase rectifier, of especially low forward resistance, has, therefore, to be provided to initiate excitation; its a.c. input is from two of the alternator terminals, and its d.c. output is fed to the alternator field winding through one pole of a small triple-pole relay. The actuating coil of the relay carries the main alternator exciting current, and the remaining two poles of the relay are connected in the a.c. feed to the rectifier, the complete circuit being included in the main connection schematic of Fig. 5. The auxiliary rectifier permits the small residual terminal voltage to circulate sufficient direct exciting current to initiate "build-up," and the contactor disconnects the rectifier from both the field winding and the alternator terminals when enough field current is flowing to ensure that build-up will continue and that the main excitation circuit will become self-sustaining.

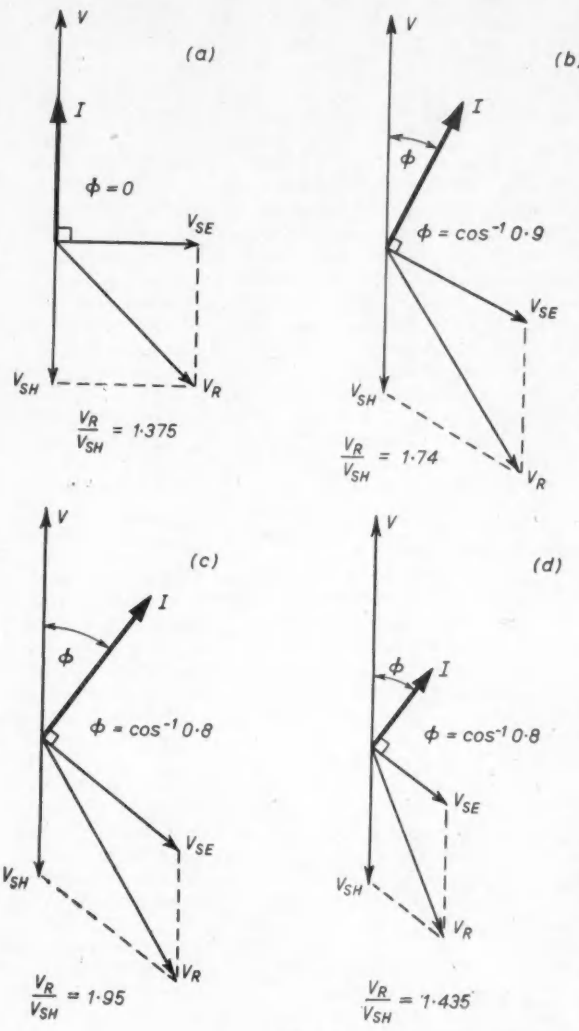


Fig. 6. Rectifier input vectors for phase-compensated static self-excitation

(a) Unity power factor—full load. (b) 0·9 lagging power factor—full load. (c) 0·8 lagging power factor—full load. (d) 0·8 lagging power factor—half load.

Owing to the linear characteristic of the series transformer and the normal design proportions of the alternator the short-time overload capacity of this statically-excited machine is relatively high; squirrel-cage motors with starting inputs of 3 to 4 times the alternator capacity can be satisfactorily direct-switched, providing, of course, that the motor drive is of the low-inertia type (e.g. a centrifugal pump) and the starting time is correspondingly short. Stable parallel operation with similar machines is readily achieved by means of equalising connections between the field windings; for parallel operation with a machine controlled by a conventional a.v.r. a somewhat drooping voltage/load characteristic is necessary, and for this purpose a tapped series transformer and a change-over switch can be supplied.

It is claimed for this type of machine that the substitution of the completely static rectifier system for the conventional exciter will result in increased reliability and will greatly reduce maintenance costs. The rectifiers and transformers used are tropically rated as a standard procedure, and it seems very likely that machines constructed in accordance with this principle will become deservedly popular abroad, where skilled attention is often at a premium.

As at present constructed this machine is not self-contained, the static equipment being separately mounted. This is not necessarily of any especial significance, of course, since in many applications a switchboard of some sort is in any case required, and the necessary rectifiers and transformers can be conveniently accommodated thereon. In some instances, however, a completely self-contained machine is particularly useful, and it is understood that the possibility of mounting the auxiliary apparatus on the machine itself is being investigated.

*Phase-Compensated Static Exciter Control**

With this type of control, which is also of recent origin, the basic principle of the phase-compensated static excitation system—the combination before rectification of voltage and current-dependent components—is retained. The necessary pre-rectification integration is in this instance obtained not by electrical connection but by flux summation, and the direct self-excitation of the alternator is abandoned in favour of the indirect separate excitation of an otherwise conventional exciter. Advantage is taken of the amplifying characteristic of the exciter and an altogether lighter control circuit becomes possible, although some compensation for the inherent non-linearity of the exciter output/excitation characteristic becomes necessary.

The basic connection schematic for this type of control is shown in Fig. 7, from which it can be seen that the field winding of the exciter is supplied from a small single-phase rectifier whose a.c. side is in turn fed from the

*Machines embodying this type of control are marketed under the trade name of "Autovol," and a more detailed description of their operation will be available in the L.S.E. Engineering Bulletin.

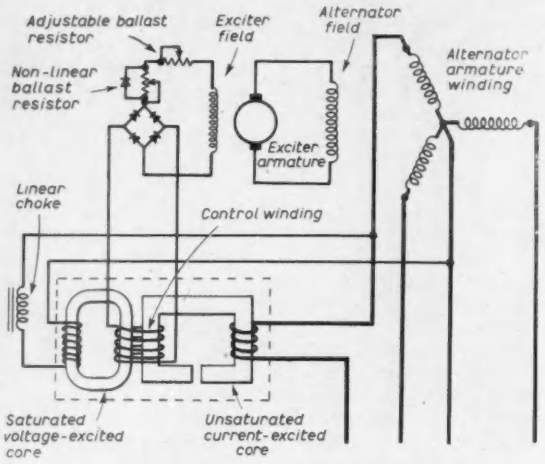


Fig. 7. Connections for phase-compensated static exciter control. Note the special "flux summation" integrating transformer, enclosed by dotted lines

secondary winding of a special two-core "flux-summation" transformer. One core of the transformer is "voltage-excited" by a primary winding connected to the output terminals of the alternator; the magnetic cross-section of this voltage-excited core is designed to saturate at below normal voltage, and the core flux is thus substantially constant, a special steel being employed to ensure a consistently reliable magnetic characteristic. The second core of the special transformer is "current-excited" by a coil carrying the alternator output current; this core section is arranged to be unsaturated, and an air-gap in the magnetic circuit ensures that the core flux is substantially proportional to the line current. A single "control" or "integrating" secondary winding embraces both the voltage-excited and the current-excited cores, as shown, and the rectified output from this control winding is fed to the field winding of the exciter through a non-linear resistance combination and an adjustable ballast resistor.

The flux Φ_V in the voltage-excited core is substantially constant in magnitude, and in time-phase it lags on the alternator phase voltage by 90°; the flux Φ_C in the current-excited core is in magnitude directly proportional to, and in time-phase coincident with, the alternator load current in the phase concerned. The use of the specially constructed transformer ensures almost perfect de-coupling between the two primary windings, with the result that the output from the control winding embracing both the cores is the vector sum of the voltages which would be separately induced in the control winding by the two core fluxes in question.

The function of the control winding is thus that of flux summation, since although the fluxes Φ_V and Φ_C in the two transformer cores are completely separate magnetically the response of the control winding is to the "apparent" resultant flux Φ_R with which the control winding is effectively linked; Φ_R is clearly the vector sum of Φ_V and Φ_C. The corresponding flux vector diagram for full alternator load at 0·8 p.f. lagging is shown in Fig. 8, although it must again be emphasised that the "resultant" flux Φ_R has no separate physical existence as such.

The similarity between the flux vectors of Fig 8 and the m.m.f. vectors of Fig. 1 is obvious, and it will be clear that by suitable design the output from the control winding can be arranged to be approximately proportional to the required alternator exciting m.m.f. If Φ_V is designed to correspond in magnitude to the alternator no-load magnetising m.m.f. and if Φ_C corresponds in turn to the armature reaction m.m.f., then inherent excitation compensation will be obtained at all loads and power factors, and the alternator terminal voltage will thus remain sensibly constant.

Voltage-level adjustment is obtained by altering the air-gap of the linear choke in the voltage-excited circuit, and tappings on the current-excited winding provide a convenient method of altering the load current compensation to suit the speed/load characteristic of the drive; a further overall adjustment is obtained by adjusting the setting of the linear ballast resistor in the exciter field circuit. The non-linear resistance combination also in this circuit provides a measure of compensation for the inherently drooping exciter output/excitation characteristic by reducing the total field circuit resistance as the rectified output voltage from the control winding increases with load; the non-linear effect of alternator saturation on the alternator load/excitation characteristic is also mitigated in this way.

PERFORMANCE.—The terminal voltage of a machine fitted with this type of static control is maintained within ±2½% of the required value at all loads, provided, of course, that the appropriate adjustment for the speed/load characteristic of the drive has been made and that this characteristic is consistent. In spite of the time delay in the exciter, the transient response of the system is excellent, and the short-time overload capacity is correspondingly high.

Since the control equipment is completely static the regular maintenance necessary with an electro-mechanical a.v.r. is eliminated, although the retention of the exciter entails the acceptance of normal maintenance routine so far as the rotating machines are concerned. It seems likely, therefore, that this type of control will prove as suitable as its exciterless counterpart for installation wherever skilled attention is at a premium, and the use of the exciter as a power amplifier enables machines of any size to be built.

For the parallel operation of two similarly equipped machines "mutual" current-dependency is a convenient solution, the current-excited winding of one machine carrying the load current of the other, and as with the previously-described self-excited machine an inherently drooping characteristic can be provided for parallel operation with conventional machines. In the form shown in Fig. 7 this system is suitable only for moderately-balanced three-phase loads (or for a single-phase machine); this difficulty can be overcome if necessary by the provision of a separate integrating transformer for each phase with a three-phase summation rectifier.

One interesting point about the flux summation transformer is its suitability for the automatic control of synchronous motor excitation. With very little modification the exciting current of the motor can be so controlled as to maintain the leading kVAr drawn from the line at any constant value (within the capacity of the motor) irrespective of the mechanical load; alternatively, or rather as a special case of the constant kVAr application, the motor power factor can be maintained at unity at all loads. The detailed consideration of this application is beyond the scope of the present article.

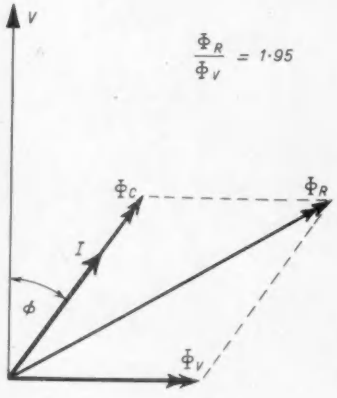


Fig. 8. Control flux vectors for phase-compensated static exciter control

(To be continued)

TOWARDS CLEANER AIR

Beaver Committee proposals affect Power Station Design

AIR pollution in Great Britain is a social and economic evil which should no longer be tolerated; it needs to be combated with the same conviction and energy as were applied one hundred years ago in securing clean water. That is the opinion of the Committee on Air Pollution, which under the chairmanship of Sir Hugh Beaver has spent something over a year in studying the problem. It is stated in the final report of the Committee, which was published last Thursday.

Broadly, the Committee consider that it should be the declared national policy to secure clean air, and that new legislation should be prepared to give expression to this view. The basis of this conclusion is the estimate that air pollution is at present costing the country £250 m per year in terms only of losses that can be given a monetary value. The estimate does not include the value of the fuel that is lost through incomplete combustion, which is recognised as one of the main causes of smoke.

Clean Air Act

The "Clean Air Act" which the Committee propose would replace all existing statutory provisions. In particular, the emission of dark smoke from any chimney would be prohibited, three years being allowed for necessary modifications and improvements. The prohibition would extend to ships and boats. There would be provision for short periods of making smoke, for instance on lighting up and while soot blowing. Apart from smoke, grit and dust emission would be dealt with. Where new industrial furnaces were installed, they would be required to be so designed that they secured the best possible standard of smoke reduction: there would be arrangements for securing prior approval for new furnaces.

So far as domestic smoke is concerned, the principal provision suggested is the granting of power to local authorities generally to establish smokeless zones, and "smoke control zones." In the latter there would be a prohibition on burning fuel containing more than 20% volatile matter. Certain grants should be made towards the cost of converting domestic appliances in such zones. The installation of "improved" appliances for the main domestic space and water-heating services would be compulsory. Responsibility for enforcing almost all aspects of the "Clean Air Act" would be placed on local authorities.

Besides these broad recommendations, the Committee makes several detailed suggestions. Many of them affect the electrical supply industry, and it is with these sections of the report that the remainder of this summary is concerned. A start may be made with a most welcome recommendation: the present purchase tax of 50% on electric and gas fires should be removed. This results from the Committee's opinion that the use of such fires should be encouraged. Another recommendation that is likely to be widely endorsed is that the factor of pollution should be taken into account by the British Transport Commission in considering future schemes for modernisation, and that consequently, the existing programme of electrification should be accelerated and extended. The idea of changing over from steam to electric or diesel locomotives on the outskirts of large towns is considered impracticable.

In the main, however, the Report affects the electricity supply industry most directly by the restrictions it suggests. In particular, it is recommended that power stations should be made subject to supervision by the Alkali Inspectorate (under an extension of the Alkali, etc., Works Regulation Act, 1906). The inspectorate would have the duty of ensuring that the best practicable methods of smoke, dust and grit control were used. In this respect, it is considered that after 1964, no power station should be allowed to operate with obsolete and inadequate grit and dust-arresting plant, or with low chimneys, except in emergencies.

Extensive consideration has been given to sulphur pollution, with special reference to flue gas washing at power stations. It is noted that at coal-fired Battersea, with a pre-war installation, about 80% of the sulphur dioxide is removed. At more recent Bankside (oil-fired), more than 95% of the sulphur dioxide is extracted. It is estimated that with new plant the cost of gas washing equipment is equivalent to 8s./ton on coal, an addition of about 0·06d./unit generated. Moreover, the system used at Battersea and Bankside could not be extended on the Thames, because the water becomes saturated with calcium sulphate.

The Report notes that a substantially cheaper process which produces sulphate of ammonia is now on the point of large scale trials at a B.E.A. power station. The Committee state that "they are not impressed by the speed with which these matters have been pursued" and while recognising the difficulties of corrosion problems and other snags, call for less hesitation in putting the method into practical operation.

It has been suggested that with power station chimneys 300 ft or more high, gas washing is a disadvantage, since it makes the flue-gases heavier, and they are no longer readily dispersed high into the atmosphere. In spite of this, however, the Committee recommend that gas washing is desirable provided it removes at least 90% of the sulphur dioxide from the gases: a lower proportion will not suffice. They adhere to this view even if the cost of gas washing amounts to 0·06d.—0·07d. per unit supplied. They warn, too, that gas washing should not be taken as a justification for lowering the height of chimneys. Yet all these precautions which it is suggested that the electricity industry should take would only remove one-quarter of the sulphur pollution at present occurring.

There are a number of appendices to the main report, and some of these are of special electrical interest. An example is a consideration of chimney height and its effect on the dispersal of flue gases. One of the conclusions reached is that when the number of stacks for a proposed power station are close together, the maximum concentration of effluent at ground level will necessarily exceed that occurring if a single stack of the same height but same total effective discharge is used.

In another appendix domestic appliances are considered, and the Ridley Committee "room efficiencies" are used as a basis of comparison. There is emphasis, however, that the figures are not reliable for comparing appliances which give their heat output in different proportions of radiation and convection.

Preventing Shaft Distortion

Construction and Operation of Turbovisory Gear for Starting Large Machines Described in Two Recent I.E.E. Papers

STARTING large turbines can no longer be carried out with complete safety relying solely on the experience of the turbine driver. This situation has developed because of the trend towards large single units operating with high temperature and high pressure steam, whereby thermal distortions of considerable amplitude can occur to the h.p. shafts. As a result much work has been done over the past ten years to devise instrumentation which can indicate the approach of conditions which may lead to serious shaft troubles.

Two papers, presented to the I.E.E. last week dealt with the turbovisory gear which has now been developed. The first of these was "Supervisory Equipment for the Indication of Shaft Distortion in Steam Turbines," and was given by Messrs D. Antrich, H. W. B. Gardiner, and R. K. Hilton.

Steel Disc Indication

In this paper, the system described utilised a steel disc, fitted coaxially to the part of the shaft which overhung beyond the outer bearing at the steam end of the machine. Around this disc were disposed three pairs of iron-cored coils or inductors, supported from the bearing housing. One pair of coils was arranged vertically to measure eccentricity in the vertical plane, one pair horizontally to detect eccentricity in the transverse direction, and one pair on each side of the disc to measure axial displacement. Each pair of eccentricity coils formed the opposite arms of a bridge circuit, the other arms of which were resistors. These bridge circuits were fed with a.c. at 1,000 c/s, 120 V from a high frequency alternator. Any shaft eccentricity produced a cyclic unbalance of the bridge, the output of which then appeared as an amplitude modulated wave. This could be rectified and, after the removal of high frequency components appeared as a low frequency a.c. signal imposed on a d.c. base. The d.c. was removed by means of a blocking transformer and the a.c. component then acted as a measure of eccentricity of the shaft. A magnetic amplifier was used to provide sufficient power to work a visual indicating instrument and a recorder. For axial measurement, a bridge circuit, excited at 1,000 c/s was again used in conjunction with a magnetic amplifier. Calibration was made possible by using a disc of known eccentricity fitted to the end of the h.f. alternator shaft, and provision was also made for displaying the horizontal and vertical components of eccentricity on the "x" and "y" axes of an oscilloscope.

In addition a small alternator, driven from the main shaft was used to give the speed of the turbine with high accuracy.

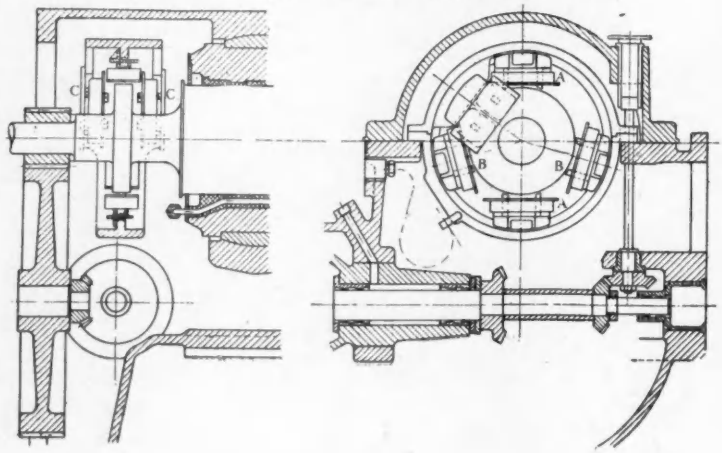
The equipment had been used on a number of steam trials of turbo-alternators in the factory, when both normal and abnormal conditions of balance, starting sequence, foundations and so on could be applied. It had also been fitted to the two 60 MW sets at the B.E.A.'s Uskmouth power station where it had been in commission since 1952.

On normal steady load, the vertical and horizontal components of eccentricity were in fair agreement and did not exceed about 0·003 in. Should the starting procedure be not correct, eccentricity might arise and warning given by the supervisory gear. The paper included some photographic reproductions of actual records of the indications during starts and abnormal running conditions and explained the traces. The authors emphasised that as shaft distortions were so closely associated with the speed and load on the set, these were now added on the chart records.

A Differing Attack

In the second paper, "The Electrical Measurement of Steam Turbine Rotor Movements with Special Reference to the Operation and Design of Modern Power Plant," by Messrs J. L. Ashworth, J. S. Hall and A. H. Gray, the attack was slightly different. Instead of utilising a separate ring shrunk on to the shaft, the system used an integral collar for the eccentricity measurements, and also adopted radio techniques for the rectification and amplification of the outputs from the detector coils. Some sixty equipments of this type had now been in operation for periods up to nine years. Troubles had been few, and had usually fallen into four groups. These were (*a*) erratic readings due to supply voltage fluctuations mainly caused by the starting of large motors, (*b*) partial deterioration of the rubber covering of the detector magnets due to oil penetration, (*c*) electrical leakage due to the presence of steam, (*d*) electronic valve failures and (*e*) accuracy of calibration. Modifications had been introduced to elminate (*a*), (*b*) and (*c*), while maintenance routines had been estab-

Fig. 1. Disc and magnet disposition (Antrich, Gardiner and Hilton)



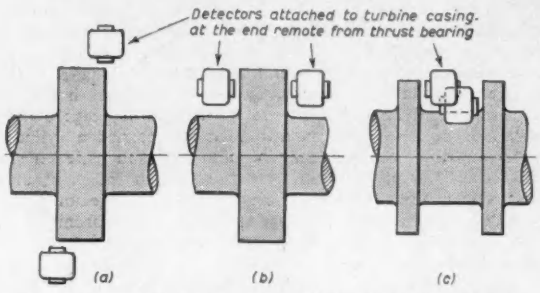


Fig. 2. Another magnet arrangement (Ashworth, Hall and Gray)

lished which eliminated (*d*). The calibration was thought to be accurate, now, to within 0·001 in.

Again, details of the indications given by the turbovisory gear under various conditions were illustrated and described in detail, mostly referring to experience on 50 and 60 MW sets. Some experience had also been obtained with turbovisory equipment on a 15 MW gas turbine installation which consisted of an h.p. and an l.p. unit, the latter being connected directly to the alternator. Each unit had been fitted with the equipment, and it had proved most effective throughout the starting and loading cycle.

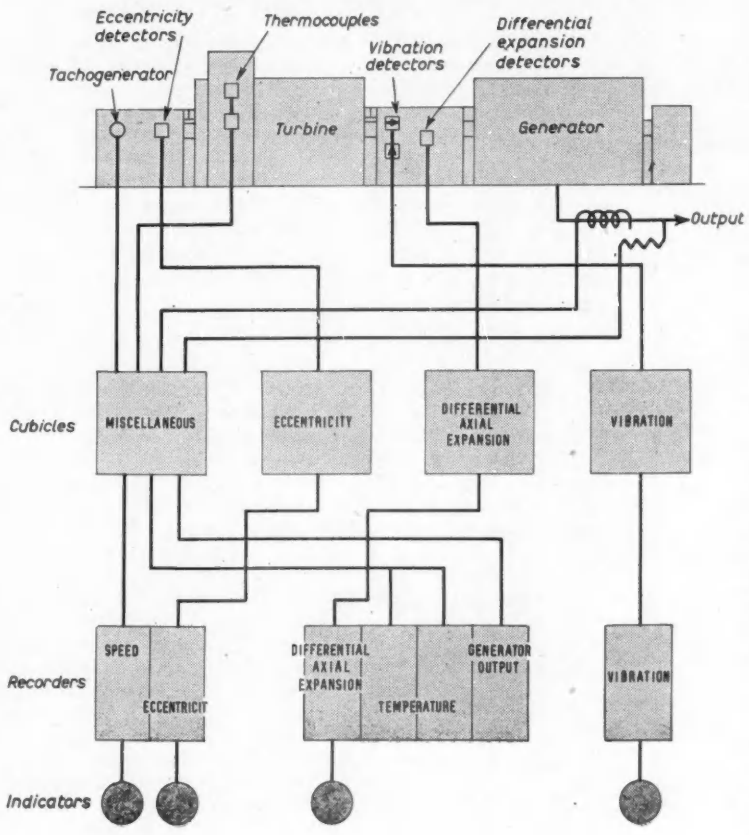
Readings and Interpretation

The eccentricity indicator was particularly useful because it could show the development of eccentricity before vibration became noticeable. The interpretation of readings was, however, complicated by the position of the indication equipment outside the steam space. Certain assumptions could, however, simplify the problem. It was reasonable to assume, for example, that normally the shaft would run with its geometric axis and its centre of mass coincident with the axis of rotation. This axis was determined by the position of the journals in the bearings and the gravitational deflection of the shaft. If it was further assumed that the curvature between the bearings was constant and that the portions at the end of the shafts were tangential at the bearing centre lines, it was easy to derive a relation between the indicated eccentricity and the radial displacement of the centre of mass. Initially it had been assumed that the centrifugal force should not exceed half the weight of the rotor, under which conditions the centre of mass should not deflect more than 0·002 in. Attempts were made to keep within this figure when the equipment was first installed, but experience had indicated that rotors ran satisfactorily with higher readings. Even with an eccentricity reading of 0·005 in. at full speed there was no serious roughness although sometimes a little vibration could be noticed.

Where deflections from thermal causes arose, the most severe curvature might be in the glands, near the bearings, and this could give a deflection curve which exaggerated the reading but reduced the effective displacement. There was also the possibility of complex deflections to be taken into consideration, but it was possibly a curious fact that no instance of the turbovisory reading underestimating the effective bend had been observed so far.

The largest eccentricity readings associated with smooth running were found in the intermediate rotors of three-cylinder machines where the three rotors and the generator were in line. Here, with the eccentricity detector magnets at the inlet end, indicated readings of over 0·010 in. had been observed with negligible accompanying vibration.

Fig. 3. Complete turbovisory equipment (Ashworth, Hall and Gray)



Operation and Design

Many of the factors contributing to shaft distortion have already been discussed in the ELECTRICAL TIMES, 23rd September and 14th October, under the heading of "Problems of Starting Large Machines," and although these were dealt with in the second paper, they are substantially the same as those described in the articles. However, turbovisory equipment was also useful in that it could indicate through the medium of chart recorders, and here, as the paper pointed out, inquiry into the reason for certain characteristics of behaviour, had been stimulated. For example, transient bending had been studied in relation to starting procedure, and the conclusion arrived at that some transient bends were due to non-uniform heating between gland sleeves and the shaft.

In conclusion it was felt by the authors that beside eccentricity and relative axial position, other readings might be of value. These included (*a*) speed and kW output — two functions which had now been in-

corporated in the records; (*b*) steam metal temperature differences; (*c*) overall expansion; (*d*) measurement of vibration, and (*e*) the position of steam valves.

The authors of each paper had a full-scale turbovisory equipment on view to illustrate its working.

DISCUSSION

MR F. SHAKESHAFT (B.E.A.), said that the wide adoption of turbovisory gear had probably saved several million pounds by the avoidance of forced outages and costly repairs. Since in the next four years the B.E.A. were to commission 100 sets of 60 MW capacity and 40 in the 100 to 120 MW class, he strongly recommended the inclusion of overall expansion gear in the equipment. This would assist the turbine driver to avoid dangerous starting and loading conditions and give a continuous recording of the outer pedestal movement. This would indicate if any "stictions" had developed due to roughening of the guide keys and other effects. Consideration might also be given to the use of further equipment to indicate leakage through the gland-steam valves. To prevent ingress of water under starting conditions the superheater and main steam-pipeline should be drained by a valve placed adjacent to the stop and emergency valves of the turbine. All large units should be provided with pressure governors to reduce the load on the turbine in the event of coal sticking in the boiler chutes. He also thought that as transient deflections could be caused by small transverse temperature differences, there was still work to be done on the investigation of thermal conductivity of rotors of either drum or monobloc construction. Investigation was already in hand into the causes of rotor journal oscillation in the oil film of the bearings.

MR F. J. HUTCHINSON (Kennedy and Donkin), suggested that in future, chart recorders would oust the log recording of instruments, and that in stations of large size there would be more men looking after the instruments than operating the station. Purely turbine supervisory gear would have to be backed up by equally critical temperature measurements related to the boiler.

MR G. R. PETERSON (B.E.A.), speaking as a user, said that in the last 4½ years on a group of 95 machines there had been 12 major shaft faults. A number of those machines had not been fitted with supervisory equipment, and there was little doubt that some of those faults would have been prevented had such equipment been available. The outage of a 60 MW machine might cost £10,000 a week, and against that background the cost of the equipment was not large. Its first use was to provide safety in starting machines, but its second was to facilitate the quick starting of machines. A saving of £700,000 a year might be possible with a reasonable acceleration in the present rate of starting up machines, and the equipment in question would help to achieve this.

COMMANDER J. H. JOUGHIN (Admiralty), said that at the moment it was not so much the cost of the equipment as its bulk and maintenance that deterred the Navy from using it.

MR E. HYWEL JONES said that since turbovisory equipment had been installed in South Wales the operating staffs had treated it with great respect and ran the machines up more carefully than in the old days. In the two stations where it was fitted they had never had a bent shaft. The apparatus was extremely reliable. Over 9,500 running hours, the labour charges for routine maintenance averaged £6. 5s. per month, and the cost of replacements in the whole period was £22. 18s.

MR C. F. SMITH, said that with the advent of turbovisory equipment many new and puzzling features of turbine behaviour had been found. Operators would have to learn to interpret the turbovisory intelligence and the remedies to adopt for each fluctuation. Equipment which experience had shown to be necessary for future machines, and which was described by the authors of the second paper, was a big improvement on previous ones and would give at a glance the whole picture required by the turbine driver.

PROF M. G. SAY commented on the fact that the general technique of the measurements in question derived almost directly from well-known telecommunications circuitry. It was an indication that the fields of the heavy and light engineer were overlapping more and more.

MR R. J. ELDRED agreed that the methods described were valuable for the centralised control of a large unit. With smaller sets, which were perhaps of only 10 or 15 MW, it was questionable whether the apparatus described should be installed.

The great majority of existing sets of this class had their own individual drivers, and were provided with gauge boards visible from the control point. Such sets carried a cylinder expansion indicator consisting of a pointer and scale on the cylinder foot and pedestal, a shaft expansion indicator, also mechanical, and if necessary an eccentricity indicator could be fitted comprising a dial gauge and probe or a vibrometer, in contact with the shaft. As a power engineer he did not like electronic valves.

MR D. CLARK said there was not much point in spending a great deal of money on equipment unless one was prepared to pay for operators who could use it to the best advantage. The salaries and wages bill for the staff concerned with a 200 MW unit would probably be of the order of £10,000 a year. It might be worth while paying more for more brain.

MR W. LLOYD WILLIAMS, speaking as a user of the equipment, said it had proved itself as an indicator of imminent trouble, but had perhaps failed as yet to indicate the cause of the trouble. It was probably building up its "case law." He was concerned with a station which for eighteen months had operated turbovisory plant, and the greatest difficulty so far encountered had been to interpret the indications.

MR H. S. HOLDEN mentioned that it was not always where the indications were given that the trouble started, and emphasised the importance of manufacturers ensuring that the cylinders would expand properly and paying closer attention to alignment to the last thousandth of an inch.

MR G. MCK. MITCHELL agreed that one of the main difficulties was to know how to interpret the results reported.

The Authors briefly replied.

TESTING AIR-BREAK SWITCHGEAR

RULES for the short-circuit testing of air-brake switchgear have now been issued in publication No. 16 of the Association of Short-Circuit Testing Authorities (A.S.T.A.). These are interim rules and have been formulated to secure uniformity in short-circuit testing of air-break circuit-breakers pending the completion of clause 40 of B.S. 862–1939, and the publication of a Standard for air-break circuit-breakers for voltages exceeding 660.

The purpose of the rules is to give guidance to the testing authorities regarding the various data required, the interpretation of the result obtained, and the assessment of the performance of the breaker.

Three classes of breaker are categorised. The first, Class A, comprises circuit-breakers complying with B.S. 862-1939 and having ratings and operating duties corresponding to B.S. 936-1940. Class B consists of circuit-breakers complying with B.S. 862-1939 and having ratings and operating duties corresponding with those given in B.S. 116-1952. Both these classes are concerned with voltages up to 660. The third category, Class C, however, breaks new ground as it covers voltages of 3·3, 6·6 and 11 kV.

The rules are usually comprehensive as they provide within a single document all the data necessary to conduct the tests without reference to other documents. Apart from the test procedure, a full set of definitions is included, with sections on the assessment of performance and permissible deviations. Appendices give details of the methods of measuring power factor, and of the requirements of the testing authority in the matter of drawings, and information from manufacturers, of measurement of recovery-voltage, determination of short-time current, and also of information to be included in records.

The document, A.S.T.A. No. 16, is available from the Association of Short-Circuit Testing Authorities, 36 Kingsway, London, W.C.2. Price 10s.

READERS' VIEWS

Correspondents writing under a pseudonym are asked to submit their names in confidence to the Editor

British Standards Abroad

IN your issue of 11th November, Mr Summers comments upon the position of British Standards in overseas markets and he relates this to the question of the statutory validity of specifications. The voluntary character of British Standards is usually well understood overseas, but the incorporation of standards in statutory regulations is not an uncommon practice and the statutory position in any particular country is, of course, a matter for that country alone.

The effort of the British Standards Institution, in conjunction with U.K. industry and trade, is to try to ensure that British Standards are well recognised in overseas markets and that their reputation is high. It is because of the success achieved in these directions that there are so many fewer instances than would otherwise occur of the kind quoted by Mr Summers—where an overseas buyer insisted on a foreign specification instead of one to which we make in this country.

H. A. R. Binney,
Director.
BRITISH STANDARDS INSTITUTION.

Fluid-Filled Radiators

MR A. W. BATES (your issue dated 11th November) has a right to be partial towards the radiant electric fire—the same right as any other English person, many of whom also have extraordinary ideas of comfort conditions. But a knowledge of heating, adequate enough to be able to appreciate the inaccuracy of his remarks, or actual experience of a properly designed system of fluid-filled radiators, will prevent anyone sharing his prejudice against that form of heating.

The conception of warming by means of transfer of heat from low temperature surfaces is quite sound and, as "Peregrin" states, has its widest application in the form of low pressure hot water radiator systems. It is only natural that this successful technique of warming should provide a basis and a name for similar systems, but electrically operated and with each radiator self-contained and filled with a fluid to diffuse the heat given off from the element.

With regard to Mr Bates' points, I have the following comments to make. (1) *Heat transfer.* The amount of heat emitted as radiation depends upon the arrangement and location of the heating surfaces as well as their temperature. Accordingly, a panel heater gives off more radiation than a column type and however disposed, emits considerably more than 15-20% radiation. While authorities are agreed that the ideal system should give both radiation and convection, there are bound to be differences of opinion as to the right proportion depending upon the application and individual requirements. (2) *Preheating.* This is necessary with all forms of intermittently used heating systems for the attainment of comfort conditions. Even with a properly designed radiant system it is necessary to reach the air temperature of 60°F, and air cannot be warmed quickly by radiation. (3) *Temperature gradient.* This is negligible with any well designed low temperature system. (4) *Ventilation.* Provided this and the room temperature are properly controlled, there need be no stuffiness nor excessive heat losses through ventilation with any low temperature system not giving off products of combustion into the room. (5) *Safety.* No electric heater made has a higher degree of safety than a good fluid-filled radiator. If Mr Bates knows of a case where a burn has occurred he should report it to the manufacturer. It will either be a badly designed or a defective heater operating, no doubt, well beyond the range of 160/180°F, which he himself mentions.

A vital point not mentioned by Mr Bates is thermostat control—indispensible for both economy in operation and the maintenance of comfort conditions—which can be applied in any form to fluid-filled radiators but hardly to electric radiant fires.

The prospects for all forms of electrical space heating have possibly never been brighter. They will not be improved if our knowledge of heating fails to match the performance of our appliances and our minds fail to appreciate that all heating problems cannot be solved with one particular type of appliance.

"Electro-thermal,"
LONDON, S.W.13.

Checking Shaft Alignment

IN your issue of 18th November, "A Steelworks Engineer" states that feeders cannot be used for checking shaft alignment unless half-couplings are truly circular, or bored at right angles to the face.

If a strip metal bridge is fitted across two half-coupling peripheries, bolted to one and offering a small gap at the other, then if feeler readings are taken first at twelve o'clock and then at six o'clock (*both coupling halves being rotated together*) the shafts are in perfect vertical alignment if readings are identical, even if one coupling is square and one oval. Similarly for the three o'clock and nine o'clock positions for sideways alignment.

In the same way it does not matter if coupling faces are untrue or if shafts float while revolving.

If feeler readings are taken between faces at top and bottom and repeated after turning both couplings through 180°, then by taking the average of the two readings and comparing with that of the two bottom readings we get the angular difference between two perfectly true planes normal to the shafts, and if averages are equal, shafts are perfectly in line. Floating of the shafts is cancelled out.

W. M. L. Hill,
DUNDEE.

* * *

I AM grateful to Mr Hill for his letter, and am of course in agreement with his suggestions which represent common practice when lining out to ensure that any errors due to coupling discrepancies are avoided. Nevertheless I think he would agree that if the face of the coupling is badly out of truth with respect to the bore the use of a clock gauge bearing on the shafts is preferable.

"A Steelworks Engineer."

A.C. COMMUTATOR MOTORS

A STEP-BY-STEP approach to the theory of the variable speed a.c. commutator motor is given in B.T.H. publication G.11010. With the aid of coloured diagrams it develops the theory from basic electro-technics. A copy of the booklet is available free of charge to any accredited lecturer writing on a business letter head to the Publicity Department (Mgr.), British Thomson-Houston Co., Ltd.

B.W.R.A. Improves Welding Techniques

ELECTRICAL interest at the British Welding Research Association open day centred on the demonstration of a new control device suitable for application to continuous feed automatic welding machines. By means of this equipment, constant arc length was automatically maintained for varying conditions of voltage and rate of wire feed, resulting in welds free from irregularity. This development was made possible by the application of a power source having an almost flat characteristic so that wide varieties of weld current were possible with small voltage change. The effect of this characteristic in providing self-adjustment of arc length, and in consequence an even weld was shown when compared with a weld produced from a normal steep characteristic power source. This particular project was carried out with the co-operation of the E.R.A.

The operator is seen argon-arc welding a test plate of high strength aluminium alloy

Assessing Weldability

Fundamental work at the Association has led to the derivation of a method for the assessment of weldability using a dilatometer in conjunction wtih a function plotter. It is hoped that when tests are further advanced, by merely quoting the composition of a steel, the weldability can be immediately assessed. For this to materialise, further research into the nature of hot-cracking, fissuring and hard zone cracking, among others, is necessary. Although research is mainly concerned with alloy steels, alloys of aluminium are not being neglected. The Association are now in a position to predict with certainty which alloys it is possible to weld and the conditions required to obtain the best results. Work on heat flow, dilution and methods for evaluating weld properties has been applied to the difficult H 10 alloy, an Al-Mg-Si material sensitive to hot cracking and porosity of weld. From these tests the behaviour of the alloy has been noted under varying conditions and a suitable welding electrode has been developed.

Building Materials from Pulverised Fuel Ash

THAT the B.E.A. is doing its utmost to publicise the uses to which pulverised fuel ash may be put was demonstrated at an exhibition staged last week. Since each year 2½ million tons are produced and by 1960 this figure will have increased to 4 millions the problems associated with ash disposal are urgent and therefore the exhibition is most opportune. A variety of building materials on display included exhibits employing up to 85% of this "waste" material.

One firm, Mitchell Engineering Ltd., estimate that if they handled the whole cutput from the B.E.A. they could produce 15,000,000 sq yd of load bearing walling—or sufficient building blocks for about 100,000 houses. Among advantages claimed for blocks so produced are greater strength, less porosity and greater durability than the conventional clay brick. In addition it is possible to drive nails or screws into the material, without preparation. Any kind of surface may be applied to the bricks, from tiling to oak veneer.

In the production of mass concrete, ash has been used in varying quantities from 15% to 40% by weight, fencing poles and kerbstones featured among examples shown. A form of clinker produced by processing the ash was said to be superior to that obtained by normal means and to be useful for making roads. It seems that, at last, the thorny problem of disposal of ash from power stations is nearing solution. To avoid high transportation costs, it is suggested that factories should be sited adjacent to the power station and thus air ducting could be employed to convey the ash.

Examples of the variety of ways in which pulverised fuel ash may be employed

New Wattmeter Design employs semi-conductors

75-YEAR-OLD PRINCIPLE USED IN ENTIRELY NEW INSTRUMENT AND MEASUREMENT TECHNIQUE

IT seems that the days of conventional power measurement techniques are numbered. A new method of measurement, based on a 75-year-old principle which until recently had only an academic interest, is now not only available but offers comparatively simple methods of overcoming the difficulties of handling large direct currents and extra high voltages. The principle involved is the Hall effect, which occurs when a transverse magnetic field is applied to a conductor carrying a longitudinal current. Under these circumstances, an e.m.f. is established in the conductor acting in a direction at right-angles to both current and field, as a result of the externally applied field producing a sideways deflection of the mobile carriers carrying the electrical energy through the conductor.

In most conventional conductors, the Hall effect is not significantly large but in semi-conductors, however, it is sufficiently pronounced to be of some value. For several years the effect has been employed in elucidating the behaviour of semi-conductor materials and for measuring steady magnetic field-strengths but, at a meeting, last week, of the I.E.E. Measurements Section, Professor H. E. M. Barlow, PH.D., B.SC.(ENG.), M.I.E.E., demonstrated its use for measuring power.

Considering the principle of operation, suppose that a block of semi-conductor, such as germanium (of either p or n type) or silicon, is placed in a magnetic field, which is made to lie along the z-axis as defined by a Cartesian co-ordinate system and as shown in Fig. 1. An electric field is then applied at right angles and a consequent current i_c flows. The Hall e.m.f. appears along the x-axis. The value of the e.m.f. is directly proportional to the current and magnetic field strength, B, and to the Hall co-efficient per unit thickness. Ignoring the latter term, which is effectively a constant, the relationship between the e.m.f. and the electric and magnetic fields is exactly equivalent to that between the power flow density in any electromagnetic field, whether steady, pulsating or alternating. Provided, therefore, that i_c and B are instaneously proportional to the electric and magnetic components of the electromagnetic field in which the semi-conductor is placed, the longitudinal power in that field will be represented by the value of the Hall e.m.f.

Whilst the device is of general application to the measurement of power or of energy transmitted in an electromagnetic field, whether supported by a guide or in free space, it is particularly suitable for use with a transmission line, a cable or a waveguide. However, to obtain a conveniently measurable e.m.f. with a power of only a few watts, it has been found advantageous to operate the semi-conductor in as strong a magnetic field as possible and hence in some cases it is necessary to increase the magnetic component at the expense of the electric component.

In operation, the semi-conductor may be considered as forming a bridge circuit, with i_c flowing into the base junction and out of the apex, and the Hall e.m.f. appearing across the two side junctions. In the absence of any flux, no e.m.f. should appear across the Hall contacts, but, in practice, it is impossible to eliminate the rectifier action of the semi-conductor by symmetry alone. However, by careful soldering or welding of the contacts it is possible to make connections which are largely non-rectifying whilst additional circuitry, in the form of either a shunt resistance or voltage divider, is employed to counteract any small change in the operating conditions.

When considering the use of this principle for practical power measurements, a difficulty to be overcome is that of low output. Mention has already been made of artificially increasing the magnetic field in which the germanium is placed to give a higher output, and a further means, especially where audio and higher frequency fields are involved, is the connection of a number of germanium units in cascade. To do this it is necessary to feed i_c to each semi-conductor unit through a capacitance to eliminate any direct current circuit formed by way of the conductors acting as a guide for the power being measured. The Hall e.m.f.'s of each unit add together to give an enhanced output; and by suitably orientating the individual semi-conductor units, any residual rectifier e.m.f.'s may be balanced out.

The value of Hall e.m.f., however, is related to the mobility of the carriers, which is not, in germanium, unduly high. It was suggested during the discussion, by Dr E. Billig (A.E.I. Res. Labs.) that semi-conductors of the class 3—5 group, such as indium antimonide, having a much higher mobility, might be employed to obtain a higher e.m.f. Supporting this view was Dr E. W. Saker (Services Electronic Res. Lab.) who pointed out that the efficiency of the semi-conductor units increased as the square of the mobility and hence, as indium antimonide had a mobility some 15 times greater than germanium, it was 200 times as efficient.

Turning now to practical instruments, the simplest means of measuring the power in a parallel strip transmission line, as shown in Fig. 2, is by merely erecting the semi-conductor unit between the conductors, the e.m.f. being conveniently measured by a high resistance galvanometer. At power frequencies it is helpful to increase the magnetic field strength by using a high permeability material situated round the busbars to form the principal part of the magnetic circuit, leaving a small air gap in the central limb in which to place the semi-conductor. Alternatively,

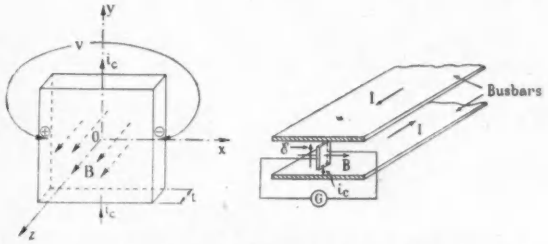


Fig. 1 (left) Illustrates the positioning of the semi-conductor unit in the magnetic and electric fields to produce a Hall effect. Fig. 2 (right) indicates a simple and effective way of measuring power transmitted along a pair of busbars

an arrangement similar to a tong ammeter could be employed, thus enabling the semi-conductor to be placed outside the busbars. Care must, of course, be taken to avoid saturation of the iron.

For lower current circuits at power frequencies, two methods are possible. In the first case, the magnetic flux may be provided by a coil wtih a laminated iron core, whilst the current is obtained by shunting the semi-conductor across a resistance inserted in the line. The other arrangement interchanges the functions of the shunt and series circuits of the instrument. In both cases, provision has to be made to vary the phase of the flux with respect to that of the voltage, to bring both into phase. An instrument based on this arrangement gave a sensitivity of about 100μV/W with a linear scale, working in a 230 V, 50 c/s a.c. circuit.

For measurements above power frequencies, the use of a high permeability core in low current circuits is precluded. With air-cored coils, however, a galvanometer amplifier of some kind must be introduced as the Hall e.m.f. is only some few microvolts/watt. The type suggested is that devised by Hill, which incorporates a differentially-operated photo voltaic cell with series feedback. At radio frequencies, where co-axial lines are often employed, several arrangements are possible, the conditions being particularly conducive to cascade connection to obtain high outputs.

One of the prime values of this method, however, is the frequency independence, over a wide range, of the semi-conductor unit, most errors on this score being introduced by either the inductance of the coil or stray capacitances. This feature thus enables the instrument to be calibrated at 50 c/s for use at frequencies where calibration would be more difficult. On the other hand, the performance of the semi-conductor was influenced by temperature, light and moisture and hence required to be carefully isolated.

Some aspects of the discussion aroused by the paper have already been mentioned but it was Professor R. O. Kapp (Kennedy and Donkin) who, in opening the discussion, ranged over some of the possibilities of the device. At the same time he pointed out that it measured only watts, whereas power engineering measurements included that of reactive volt-amps. This limitation, however, was not thought to be serious and Professor Barlow, in reply, indicated that he thought the system could be adapted to measure this parameter. On this score, Professor F. Brailsford (University College, London) suggested that the wattmeter could well be designed to have a low phase angle error, and would thus be useful for measuring power losses at a p.f. of less than 0·01.

Also presented at the meeting was a paper discussing the measurement of power at audio frequencies using dynamometer wattmeters. Given by Dr A. H. M. Arnold, PH.D., D.ENG., A.M.I.E.E., it discussed the precautions necessary in screening and in determining frequency dependent errors of the instrument.

Power Engineers and the Future

NO one has done more to keep down the costs of the supply industry than the technical engineers and the manufacturers, said Mr Ernest Hanson, President of the E.P.E.A. last week. While the Association was second to none in looking after the technical staff of the supply industry, it was concerned with the efficiency of the industry as well as with the salary and status of its members. There was no industry in the country which had kept and improved its efficiency like electricity supply. Mr Hanson was replying to the toast of the E.P.E.A. at the annual dinner of the Association held in London on Friday.

He went on to say that the Association was determined not to become a political forum of any party. The Association happened to have an M.P., but "choose whatever party he belongs to, you could only get the best of service from an E.P.E.A. member." Mr Palmer had done sterling work in the House of Commons, and it was largely due to him that certain amendments were made to the Electricity Reorganisation (Scotland) Act during its passage through the House.

The supply industry has always been ready to co-operate with anyone with new ideas, and he said to Sir John Cockroft, the atomic scientist who was one of the principal guests, that they were looking to him to provide better as well as cheaper methods of generating electricity. Although they had no direct representation on the Atomic Energy Commission, they were watching its work closely.

South of Scotland

The toast of the E.P.E.A. had been proposed by Mr J. S. Pickles, chairman-elect of the South of Scotland Electricity Board. He explained that as the new board had not met, and its composition had not been announced, he could make no policy statement. However, although it was to some extent true to speak of separation, that should not be taken to mean isolation. The new board and its staff would remain part of the whole nationalised supply industry. It would be their constant aim to keep in the closest touch with the South of Great Britain not only on engineering matters, but also in terms of free movement of personnel. However, although that applied on the engineering side, the position on the administrative and commercial side, which did not intimately affect the E.P.E.A. was rather different. Even here, doubtless close contact would be maintained between officials on a personal basis.

Speaking as a former member of the E.P.E.A., Mr Pickles said he was glad to note that the Association not only looked after pay and conditions of work, but also paid attention to status and to education. It needed to be remembered that in the long run the Association's prestige depended not only on its service to its members, but on its service to the community in general.

"The Supply Industry" was the toast which Sir John Cockroft proposed. He recalled that he studied electrical engineering under Professor Miles Walker, and began practical training as an electrical engineer before going to work with Lord Rutherford and becoming a physicist. Speaking of the progress in nuclear power production, he expressed his personal belief that electrical power engineers could look forward to transmutation into nuclear engineers. It would be wrong, he thought, to say how quickly present nuclear power stations were progressing. In the United States, where they were less inhibited on the subject, there was talk of one-quarter of industry running on nuclear power by 1970. There was certainly a lot to be done before that stage was reached.

Mr D. Bellamy, Chairman of the Yorkshire E.B. replied to this toast. He suggested that injecting organisation into the branches of electricity supply was the need to make the best use of the available raw materials, and thus to produce the cheapest electricity. It had to be remembered, however, that those in the industry must receive the remuneration they deserved. Each should take from the industry what he was entitled to. The industry was looking for men who would turn stumbling blocks into stepping stones, not for those who made difficulties.

notes on wiring

by Megohm

QUITE a number of people have asked when I intended to continue my observations on hospital installations. In my Notes of 21st October, 1954, I failed, through lack of space, to cover the general lighting and power requirements. Although these requirements are perhaps the most common part of the electrical system, they are very often the subject of much debate and deliberation. In general, the lighting and power required does not differ from that required in any other large building. Wards however, do require some special requirements.

Lighting

Good general lighting is necessary in the wards and corridors. Care must be taken in the choice of fittings for the wards to ensure that patients are not subjected to eye strain. Patients have told me that the ordinary sphere fitting becomes a "ball of fire" in time, and I can well appreciate this. Much of this bad effect can be done away with by the use of a larger sphere than is normally specified for the size of lamp used. Each bed should also have its individual bedlight. It is not desirable for these bedlights to form part of the general ward lighting as every patient may not wish to have the bedlight on, and this would affect the general illumination of the ward. There are many types of brackets on the market today and certain of these form part of a bed unit arrangement, comprising inspection light socket, radio control, call system push and any other requirements. Many of these units can be made to suit special requirements and manufacturers are only too willing to co-operate.

Night lighting is most essential in ward lighting and many types of fittings have been designed for this purpose. I have found that the opinions of the persons in charge vary almost as much as the types of fittings. The most common type of night lighting is provided by means of a second lamp in one or more of the general fittings. This arrangement has at least one thing against it, for if I happened to be a patient in a ward lighted in such a way, I would be kept awake half the night.

If it is desired to keep the night lights at a high level, the most effective method is to employ a small inverted metal bowl combined in one of the general lighting fittings. This arrangement does, however, form a dust trap and might become a source of danger in the eyes of the medical people. I recently saw one method of night lighting which, to my mind, is the real answer to the problem. Louvred boxes were sited at suitable positions and at some 18 in. from the floor. This provided ample illumination on the floor to allow a nurse to walk down the ward and the light, being below the level of the bed, did not disturb the patients. It also provided a comforting glow for those patients who, unfortunately, could not sleep. One thing which must not be overlooked is the important factor of providing enough light at night for the nurse in charge of the ward to *see* the patient. A nurse can tell if the patient shows any change by merely looking at him or her.

Fluorescent lighting has received considerable attention for hospital lighting. Here again the choice is with those in authority, and it is most commonly used in pathological departments, lecture rooms and administration offices.

Socket-Outlets and Emergency Lighting

It is normal to provide a five-ampere socket outlet at each bed position for inspection lamps. It is essential to provide an adequate number of sockets per ward, in order to eliminate the need for long flexible leads. I arrange for four such sockets to be wired in 3/·036 cable on one circuit so that a load of 1 kW can be connected. The possibility of four adjacent sockets being used at the one time is rather remote.

Sockets of 15-ampere size must be installed for portable X-ray or other medical apparatus. These sockets may also be paralleled up in order to cut down expense. Even in large hospitals, portable apparatus is limited and this helps to provide the "diversity factor" which we always look for. An adequate number of sockets should be provided in corridors etc. for floor polishing machines and cleaners.

Emergency lighting must be provided in operating theatres to guard against a failure of lighting during operations. The rooms adjacent to the theatre require this service also. The sterilizing and anaesthetising rooms must be kept going in such circumstances. The usual practice is to install an emergency lighting battery which is maintained in a fully charged condition by means of a trickle charger. The battery should be of sufficient ampere-hour capacity to maintain all the emergency lights at full power for a period of approximately three hours. The lights are automatically switched on by a contactor, the operating coils of which are connected to the same lighting circuit as the lights in the rooms wired for emergency lighting. Any failure of the supply brings the emergency lighting into operation. The scyalitic lamp also requires a current relay, with its coil in series with the lamp to ensure that the emergency lighting is switched on if the lamp fails.

Electro-medical Apparatus

It is essential to provide an adequate number of sockets in the massage department for the operation of the varied apparatus usually found in this section of the hospital. If short wave diathermy sets are used it is necessary to take precautions to avoid interference with radio, television and radar sets. The apparatus must be "screened" and, in new buildings, this is usually done by lining the walls with a wire screen of not more than $\frac{1}{4}$ in. mesh, the sections of which must be bonded together and "earthed" to a buried metal plate. The doors and windows must also be screened and it is usual for the architect to make the necessary arrangements for these to be of a suitable pattern. Ultra-violet and infra-red lamps are also used extensively here.

The u.v. lamp is often used in the gymnasium of the physiotherapy department. The physiotherapist usually requires the socket for this purpose set flush in the floor. I do not care for the socket to be in such a position, and in such cases I arrange for a d.p. tumbler switch to control the outlet.

New Traffic Control in Oxford Street

AFTER a period of some 24 years, Oxford Street, a notorious traffic thoroughfare, has been converted from fixed-time light signalling to a vehicle-actuated system. Installed by The Siemens and General Electric Railway Signal Co., Ltd., the new Autoflex system uses a modern electronic master controller to generate a master cycle time which is conveyed by tie lines to local controllers of the most modern type. This has already resulted in an increase in speed during busy periods by as much as 20% and a reduction in waiting time by some 30%. The local controllers can modify the "progressive" control exercised by the master controller. For example, unless a demand has been received from a side road they will not transfer right-of-way from the main road, and in the event of side road traffic clearing ahead of the progressive sequence, the right of way will be restored as soon as practicable.

The detectors are installed in side roads at 15 of the 16 signalled crossings; and the most important crossings have detectors in Oxford Street as well. Owing to the variation in traffic conditions between night and day, weekends and normal working and the heavy pedestrian traffic, facilities have been developed to vary the mode of signalling as these factors take effect. The changes are introduced by an integrator which, on the basis of information received from all the detectors, can assess the traffic density and vary the time cycle accordingly. It can also introduce artificial demands for right of way when vehicles are temporarily stationary over the detectors. The impulses from the detectors are summated over a specific time interval, and compared with those stored in the previous interval. If the new reading differs by more than a fixed amount it is stored in place of the old. The stored result is used to change the mode of operation of the signals. Special arrangements are provided whereby local signalling installations follow the cycle timing of the Oxford Street master controller. At this controller, the impulse-generating equipment is in duplicate and provided with a monitoring device which will switch in standby equipment if the working unit fails. The installation was formally opened last Monday, 29th November, by the Minister of Transport and Civil Aviation, the Rt Hon. J. Boyd-Carpenter, and has already excited favourable comment from motorists and other users of this major road.

Heat Treating of Stainless Steel

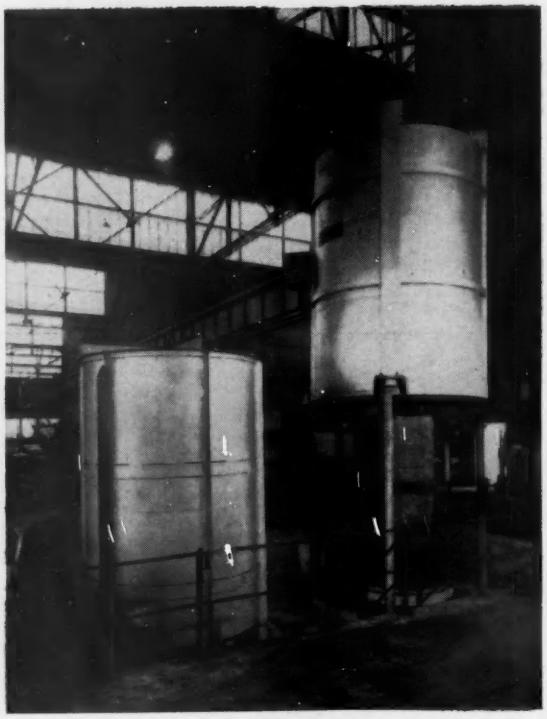
AN electrically heated bell furnace with two charge bases has recently been supplied to the Shepcote Lane Rolling Mills Ltd., of Sheffield, a subsidiary of Firth-Vickers Stainless Steels Ltd. Manufactured by G.W.B. Furnaces Ltd., this furnace carries out the batch softening simultaneously of two coils of stainless steel strip of 17% chrome quality at 780/800°C. The coils each weigh about 10,000 lbs, and are 4 ft in diameter with a width of 39 in.

As can be seen from the photograph, the coils are carried on a central column with radial supports. The whole weight is thus taken on the cast heat-resisting steel column, which is fixed into the hearth brick work. A powerful electrically driven fan sucks air down through the annular space left on the inside of the coils and then blows it up around the outside of the coils and over the heating elements situated around the wall of the furnace. This ensures that uniform heating is obtained. There are two bases, so that when one set of coils is cooling another pair may be in process of heating.

When the soaking period is completed the heating bell, rated at 220 kW, is lifted off and replaced by an open topped sheet steel cover to prevent direct radiation from the hot charge to workmen in the vicinity. The normal process cycle covers a total of 14 hours, which includes a soaking period of 2-4 hours. Usually a temperature of 750° C is attained within six hours. With the two bases, the furnace can thus be worked almost continuously, the bell furnace being transferred from one base to the other alternately.

The heating bell is lined with refractory fire brick, backed by Dome insulating bricks, and the heating elements are of heavy gauge nickel-chromium strip arranged in sinuous form around the lining. This strip is carried on nickel-chromium hooks imbedded in the brickwork. Electricity is fed to the furnace via spring loaded butt-type contacts on the underside of the bell which mate with a similar set of contacts installed in the floor by each base. The supply is fed through an oil circuit-breaker to these contacts.

Instrumentation includes an indicating controller of Kent manufacture, and a Kent 3-point recording instrument giving a positive check of thermal conditions on either base and on the heating bell itself.



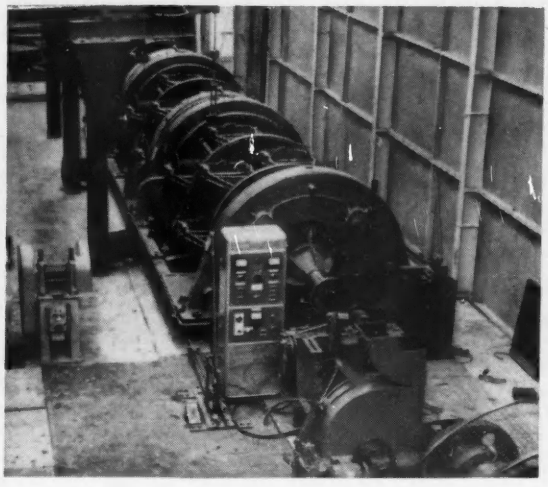
The 220 kW heating furnace showing right, the heating bell raised to expose the core with two coils in position. On the left is the screening cover resting on the other base

Producing the Transatlantic Telephone Cable

IT will be recalled from the recent I.E.E. paper describing submarine telephone cable to span the Atlantic, that the British contribution to the scheme is to be the production of the major part of the cable and of the submerged repeaters included in the Newfoundland to Nova Scotia section. Production of the cable commenced on Friday with the opening of the new Ocean Works of Submarine Cables Ltd. (jointly owned by the Telegraph Construction and Maintenance Co., Ltd., and Siemens Bros. and Co., Ltd.), by the Postmaster-General, the Rt Hon The Earl De La Warr. At a visit to the works last week opportunity was taken to inspect the production of this cable.

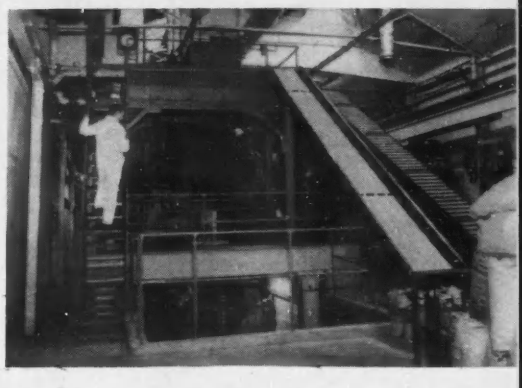
Insulation of the cable is effected with polythene mixed with a small proportion of butyl rubber and anti-oxidant, to improve its mechanical properties. This mixing forms the first stage of the process, the insulant being formed in a 6 in. wide strip which is cut up into small cubes. The central conductor, comprising a central solid wire around which are wrapped three copper tapes, is then prepared on a stranding machine, whose product passes through extrusion machinery where it receives its insulation. At all stages, careful control of diameter and quality is maintained, whilst the core is also subjected to electrical tests up to 400 kV.

Over the core are then wound six copper tapes, a binding tape and a jute serving. After further tests the served core then receives its taped steel armour wires, two layers of jute outerserving and three layers of compound in one operation to complete it. Prior to stowing aboard the cable ship, the cable is stored in specially built tanks, and it is at this stage that the repeaters are incorporated.

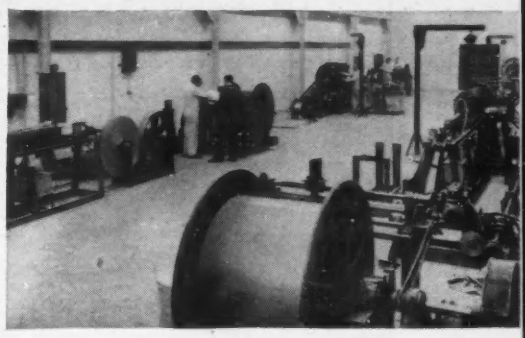


Left is shown one of the armouring machines which applies taped armour wires, outer jute serving and compound

Initially, the polythene insulant is prepared in this machine, where it is mixed with butyl rubber and anti-oxidant

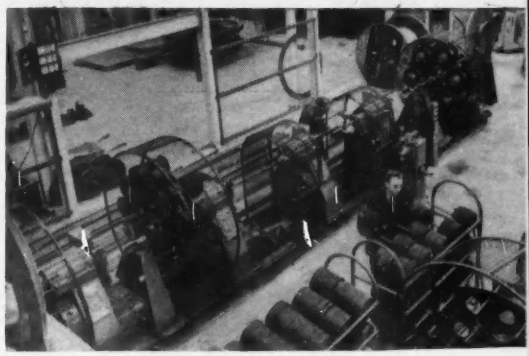


These stranding machines prepare the central conductor of solid copper wire wrapped with three tapes, to a high degree of accuracy in the final diameter

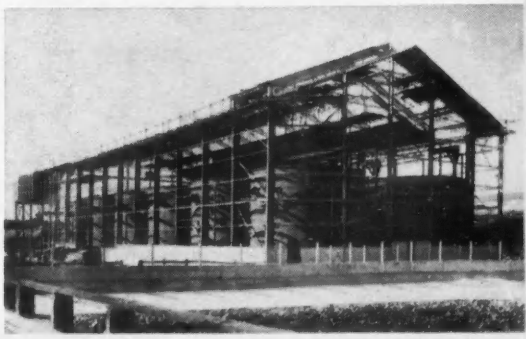


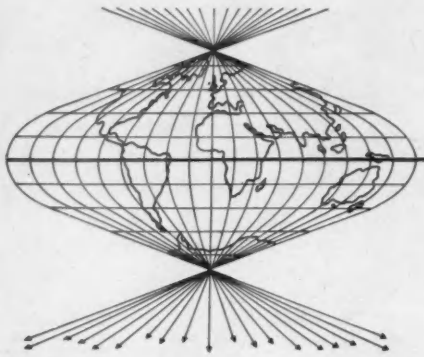
From the stranding machine the conductor is passed into the extruding machinery where it is insulated

The copper taping machine is employed in laying simultaneously six copper tapes over the core, together with a binding tape and jute serving



From the armouring machines, the cable passes directly into these cable tanks, where it is stored and where the repeaters are joined into it.





OVERSEAS NEWS

A SUMMARY OF IMPORTANT EVENTS

CANADA

Power for the Interior

The British Columbia Power Commission has reached an agreement with the city of Prince George concerning an electricity supply for the latter's area. Under this the Power Commission will endeavour to find a suitable hydro-electric power source to meet the long-term needs of the province's central interior. The Commission is given until the end of 1955 to make these investigations and if a suitable site is found it is to negotiate with a view to purchasing the city's supply system. In the meantime the Commission will lease diesel generating plant and a rural distribution system to the city-owned undertaking. The latter already operates diesel plant, but additional plant is needed to meet the expanding load.

Extensions

The Port Credit Public Utilities Commission, Ontario, has received the approval of the Hydro-Electric Power Commission of Ontario to the expenditure of $50,275 for extensions and improvements to its electrical distribution system.

C.S.A. Move

The new laboratories and offices of the Approvals Division of the Canadian Standard Association at Rexdale Building and Brydon Drive, Township of Etobicoke, were officially opened a short time ago. The Division actually moved from its previous quarters in Toronto during the latter part of August.

Discussions at Winnipeg

Reporting to the Winnipeg City Council concerning proposals for the transfer of power distribution facilities, Mr H. L. Briggs, general manager of the City Hydro undertaking, stated that technical representatives of the city had been instructed to continue the discussions and to bring them to a conclusion as rapidly as possible. He said that so far a great deal of progress had been made in the talks between representatives of the city undertaking and of the Manitoba Power Commission. Under the proposals, the distribution system of the Winnipeg Electric Co. within the city would be transferred to the City Hydro, while the latter's properties outside the city limits would be transferred to the Manitoba Power Commission. But Mr Briggs emphasised that if that arrangement was agreed to, the City Hydro would have to take a substantial bulk supply from the Manitoba Hydro-Electric Board, and the price of that power supply was a most important consideration. There was also a problem in agreeing on methods of splitting costs of properties transferred.

HAITI

Telephone Contract

A contract worth $2½ millions has been awarded to the General Electric Co. Ltd. for extensions to the telephone system of Haiti, in the Caribbean. Besides extensions to telephone exchanges in Port-au-Prince—the capital of the Republic—and other towns, as a result of which some 3,300 new subscribers will be connected, the contract provides for the building of 500 miles of open-wire trunk line routes. The associated carrier telephony equipment, at terminal stations and at points along the route, is also to be supplied. Where mountainous terrain makes the construction of lines uneconomical, V.H.F. trunk radio is to be incorporated.

A large part of the contract consists of street cable and pole routes, the material for which is to be supplied by Pirelli-General Cable Works Ltd. Shipments will start in three months' time and will continue for a further eighteen months. The work of installation and erection, which will be carried out by local labour under the direction of G.E.C. engineers, is expected to take three years to complete.

RUSSIA

Changed Responsibility

The Praesidium of the Supreme Soviet has created a Ministry of Power Station Construction to take over from the Ministry of Power Stations all responsibility for the building of new power stations and power supply networks, it has been reported.

Other news from Russia is that two prototype T 3 diesel-electric locomotives for main-line goods traffic have successfully completed trials. These engines can haul trains of over 4,000 tons at high speeds and are also suitable for passenger traffic, it is claimed. They were built at Kharkov.

EUROPE

Loan for Austrian Project ?

The World Bank is giving "sympathetic study" to Austria's request for a loan of about $40 millions to help finance a new hydro-electric project, according to informed sources. But it will probably be several weeks before the executive directors of the Bank act on a report on the project now being prepared in the light of a Bank mission's investigations. Plans for the hydro-electric scheme call for a plant on Lake Lunersee, and much of the power would go to Germany. According to the report, Dr Julius Raab, the Austrian Chancellor, nearing the end of an official three-day visit to the United States, has also been seeking American support for a large power scheme in which Austria would co-operate with Italy, France and Germany. Bank officials said that Dr Raab had not approached the Bank directly during his visit here. But it was reported that the scheme, known as the Interalpen project, was regarded as Bank officials as "a very interesting and ambitious idea." Dr Raab had estimated that the Interalpen project would cost about $120 millions in the first stage, and that the three stages of development would run into a total of about $400 millions. The project meant harnessing mountain waters in a section of the Austrian, Italian and French Alps. Germany and Northern France would be major recipients of the giant power link-up. It has been emphasised by Bank sources that this project has not entered more than a discussion stage as yet.

Insulator Production

An improvement in the production of high-tension insulators in Yugoslavia has resulted from the visit of Mr Felix Singer, a consulting ceramist, of South Croydon. Mr Singer has just returned to Britain having completed a mission lasting several months in Yugoslavia, under the auspices of the United Nations Technical Assistance Programme.

Mr Singer reported that considerable progress had recently been made in the relatively new Yugoslav ceramic industry. The country has for many years relied on imports of electro-insulators. While arrangements for manufacturing insulat-

ing porcelain were initiated not very long after the war, two problems in particular required urgent attention. They were those of increasing the plasticity of local clays and of increasing the strength of the final product.

During Mr Singer's stay in Yugoslavia it proved possible to raise plasticity by 40%, thus permitting much quicker work and greatly reduced breakage during handling. Co-operation of factory personnel also helped in reducing breakage losses from 80% to 10%. It was also found possible to increase the mechanical strength of the product by 50%. This involved the use of improved glazes which in turn also greatly enhanced the appearance of the insulator. According to Mr Singer, Yugoslavia—using local materials—will be able not only to meet her own needs for electro-insulators but also to enter the export market. Some of the insulators have already been ordered, for example, by Turkey.

INDIA

Rural Subsidy?

The suggestion that rural electrification in India should be subsidised (as we reported on 4 Nov.) is now under consideration by the Government of India, Mr Arun Chandra Guha, the Union Deputy Finance Minister, has stated. The Central Government, the Minister added, had also under contemplation a "pool" scheme by which loss in one sector of the rural electrification scheme should be made up by the profit in urban areas. Even if the loss was not made up, the State Government concerned might approach the centre for a subsidy. Mr Guha said that the scheme though not yet finalised, was likely to be accepted by the Central Government to help electrify rural areas. This was necessary not only for lighting purposes but also for starting small-scale rural industries to increase employment.

Wind Power

India has great potentialities for the development of wind power, in the opinion of Mr E. W. Golding, head of the Rural Electrification and Wind Power Generation Department of the E.R.A. Mr Golding, who attended the symposium on wind power and solar energy held in New Delhi in Oct., was requested by the Government of India to suggest economical utilisation of wind power in India. He has completed a fortnight's study tour of certain parts of the country, and is expected shortly to submit his report. In an interview, he has said that the small hills on the coastal strip of Saurashtra would prove good sites for development of wind power. In the dry interior parts of the State he felt windmills could be erected for pumping water. But the sites should be carefully selected as the wind velocity there was not very high. In Belgaum district of Bombay there was a number of points where windmills could be erected for generation of electric power to assist local electrical systems. Lower down in Travancore, Coimbatore and Cape Comorin areas, some favourable spots could be found, especially between the gaps of mountain ranges.

AUSTRALIA

Rural Loans

The State Electricity Commission of Victoria was holding £1,870,000 in advance loans, including accrued interest, against extensions to be made to rural dwellers under the "self help" scheme, the Minister for Electrical Undertakings, Mr Galbally, stated in the Legislative Council recently. He said 7,006 rural dwellers had applied to the Commission under the 50% advance scheme to be connected, and 2,912 were still waiting. Under the 100% "self help" scheme, which ceased in Sept., 1953, 63 of the 463 applicants remained to be connected. Mr Galbally said the commission was holding £1,116,000 in respect of applicants connected and £754,000 for those not yet connected. Area loans had also been subscribed to the extent of £350,000 in respect of areas connected, and £720,000 for unconnected areas.

Uniform Standards

The desirability of uniform standards for electrical appliances made in the various States in Australia, was stressed at the annual conference of the Electricity Supply Association of Australia which was held at Victor Harbor, South Australia, last month. The conference also decided to examine means of increasing its assistance to the Standards Association of Australia, and to set up a committee to investigate the operation of television sets in Australia. In his inaugural address as president of the Electricity Supply Association, Mr A. W. Knight, Hydro-Electric Commissioner of Tasmania, said, electricity was already the backbone of secondary industry in Australia and was also increasingly important in primary industry. The future prosperity of Australia depended largely on the availability of electric power at reasonable cost.

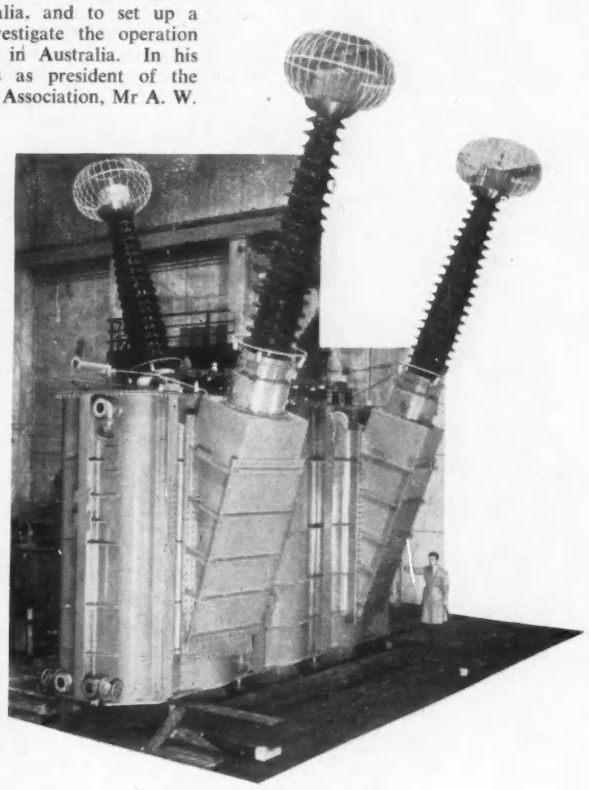
Better Lighting

At another annual conference, that of of the Illuminating Engineering Society, Australia, the standardisation of street lighting was strongly urged. The acting Lord Mayor of Perth, Councillor A. Spencer, claimed that in 90% of Perth's streets trees were responsible for poor street lighting. It was stated that the society's street lighting committee had been asked by the Minister of Works, Mr Tonkin, to submit a plan for improving the lighting on the Stirling highway, in Western Australia.

NEW ZEALAND

Roxburgh Progress

The revised contract for the Roxburgh hydro-electric project, in South Island, provides for all works necessary to have the first two generators in operation, to be completed by the end of Jan. 1957, it has been revealed. The foundations of the No. 1 generator are almost complete and the draught tube liner is now being assembled. By next Apr. the control building is to be complete to enable the State Hydro-Electric Department to commence the installation of equipment.



Shortly to be installed at Ligga power station, about six miles below Harspranget, north of the Arctic Circle, in Sweden, is this large transformer, which has recently been under test at the works of A.S.E.A. in Sweden. The transformer, of 100,000 *kVA capacity, has a rated voltage of* 13·5/400 *kV. Its total weight is* 220 *tons, the length being* 28 *ft, the width* 9½ *ft (across the bushings* 28½ *ft), and the height* 32½ *ft. The manufacturers claim that this is the largest three-phase transformer yet constructed*

Personalities IN THE INDUSTRY

Formerly with Sangamo Weston Ltd., **Mr P. J. Lovegrove** has joined Measuring Instruments (Pullin) Ltd., as sales manager to the company.

The Council of the Institute of Welding has awarded the Sir William J. Larke Medal for 1954 to **Dr C. L. M. Cottrell** for his paper "Hydrogen—Barrier to Welding Progress?" Dr Cottrell, who was until recently a member of the staff of the British Welding Research Association, is now on the research staff of the English Electric Co., Ltd., at Rugby.

Mr S. J. Davies has been appointed a technical representative of the Jackson Electric Stove Co. Ltd., attached to their Liverpool branch covering the Merseyside and North Wales Electricity Board area. Mr Davies was formerly with Birkenhead Corporation Electricity Department and subsequently with the Merseyside and North Wales Electricity Board in the Welsh and Liverpool areas.

Formerly chief accountant to the B.E.A., **Mr D. W. Coates,** C.B.E., M.A., LL.B., F.C.A., has been appointed a part-time member of the Divisional Management Committee of the North West, Merseyside and North Wales Division of the B.E.A. Mr Coates, who retired from the position of chief accountant to the B.E.A. in April 1951, has since continued to advise the Authority in a consultative capacity.

A presentation has been made to **Mr F. J. Tucker,** of Loftus (Yorks), to mark his retirement from the service of the North-Eastern Electricity Board after many years as an engineer. The presentation was made at Saltburn by **Mr E. J. Grubb,** sub-area engineer of the Board.

Mr A. E. Booker has been appointed sales engineer with Transformers (Watford) Ltd. He joined the company (then Transformers and Welders Ltd.) in 1938, after seven years with the County of London Electric Supply Co. Following war service with the R.A.F., he rejoined the firm in 1946 as production manager.

The composition of the trade mission which is to visit Egypt, the Sudan and Ethiopia next year, has been given by the President of the Board of Trade. The leader is **Sir Edward Benthall,** K.C.S.I., and the deputy leader of the mission is **Mr G. C. R. Eley,** C.B.E., director of the Bank of England, who is also a part-time member of the London Electricity Board. Mr Eley will be leader of the party in Ethiopia. Other members of the mission are: **Mr A. W. Berry,** M.I.MECH.E., M.I.E.E., director of the British Engineers' Association, **Mr T. A. L. Paton,** B.SC., (ENG.), M.INST.C.E., M.SOC.C.E.(FRANCE), partner, Sir Alexander Gibb and Partners, and **Mr J. F. Perry,** A.M.I.E.E., managing director, Metropolitan-Vickers Electrical Export Co., Ltd.

Maj.-Gen. H. C. Goodfellow has been appointed a director of Radio and Television Trust Ltd.

Mr H. D. Drysdale has been appointed a director of Morphy-Richards Ltd.

Elected president of the Electrical Trades' Commercial Travellers Association for the ensuing year is **Mr A. T. Haywood,** a director of Electrical Components Ltd. The new chairman of the Association is **Mr J. H. Bowen,** who was for many years associated with Siemens Electric Lamps and Supplies Ltd, before becoming a director of John Bowen Fittings Ltd. Mr Haywood was president of the Birmingham Electric Club in 1944/45 and 1950/51. He has been vice-president of the Midland branch of the E.T.C.T.A. since its inception, and is well known for his work in connection with the E.I.B.A. in that area. He is also a member of the Electrical Wholesalers' Federation. At the annual general meeting of the E.T.C.T.A., held recently, the allocation of monies from the Benevolent Fund was distributed as follows: Royal Commercial Travellers Schools, £52. 10s.; I.E.E. Benevolent Fund, £5. 5s.; Commercial Travellers Benevolent Institution, £2. 2s., and E.I.B.A., £350.

Mr A. E. Booker

Mr A. T. Haywood

Mr J. H. Bowen

Our accompanying photograph was taken at the Birmingham works of William McGeoch and Co., Ltd., when **Mr A. Ansell,** foreman of the firm's Ships Electric Fittings Department, was presented

Presentation at McGeoch's Works

with a cheque in recognition of his 58 years' service with the company. The presentation was made by **Mr W. Percy McGeoch,** works managing director. Shown in the photograph, from left to right, are: (seated) **Mr A. Ansell, Mr W. P. McGeoch,** and **Mrs Ansell;** (standing), **Mr C. C. Knowles** (works-manager) **Mr. J. Darby** (present manager of Mr Ansell's department), and **Mr I. H. Macqueen** (works production manager).

Croydon Corporation have approved a recommendation that **Mr F. N. Rendell-Baker,** M.I.E.E., should be invited to act in a consultative capacity to the Corporation on matters relating to street lighting and electrical installations, for a further period of twelve months at the present fee of £500 a year. At the same time the Council decided to appoint a new whole-time electrical engineering assistant on the borough engineer's staff, at a salary of £1,050/£1,250 p.a., who will undertake the technical and executive work in connection with electrical matters. Mr Rendell-Baker has been acting as adviser and consultant to the Corporation since April, 1948. There were some protests at the time, it being pointed out that only a month before he had retired from the position of chief engineer and general manager of the

Corporation's electricity undertaking at the age of 62 on a pension of £1,685 per annum. At that time he was also acting as consulting engineer for the new Croydon power station, for which he received fees in the region of £8,000 a year, it is stated.

At present station chemist at Earley generating station, **Mr G. C. W. Comley** has been appointed chief chemist at the Stella North power station, North Eastern Division, B.E.A.

Mr J. V. Brooks, B.E., A.M.I.E.E., has been appointed in charge of operations, Electrical Operations Branch, Production Department of the State Electricity Commission of Victoria. Before joining the Commission in 1951, Mr Brooks was with the Hydro-Electric Commission of Tasmania, and was earlier with the Metropolitan-Vickers Electrical Co.

Mr J. Douglas Green, M.I.E.E., chairman and director of Green and Smith, Ltd., electrical contractors of Leeds, and a past vice-president of the Electrical Contractors' Association, has been presented with a hot plate, and cutlery, by his fellow directors and staff, to commemorate his semi-retirement and resignation as joint managing director some months ago, since when he and Mrs Green have visited Brazil in connection with electrical equipment for a flour mill.

OBITUARY

Mr A. E. Williams, West of England representative for Falk Stadelmann and Co., Ltd., died on 24 Nov. He had represented that concern for over 30 years in the Nottingham, Southampton and West of England areas.

Mr F. R. McBride, who was with Laurence, Scott and Electromotors Ltd., for more than fifty years until his retirement in 1945, died on 18 Nov. For a considerable part of his service with the company he was in charge of the test bed, and he was the friend of a great many inspecting engineers.

Mr J. B. Colbran, who was district manager at Builth to the Shropshire, Worcestershire and Staffordshire Electric Power Co. until 1948, died on 23 Nov., aged 72.

Ald Charles Terry, C.B.E., J.P., chairman of Herbert Terry and Sons, Ltd., died on 24 Nov, aged 86.

Mr C. H. Batten, a joint managing director of Ductile Steels Ltd., has died.

Lt.-Col. F. N. Fawcett, who served for many years with the South Wales Power Co., died on 23 Nov., aged 64.

Prof. Enrico Fermi, whose work in the nuclear field contributed much to the harnessing of atomic energy, died in Chicago on 28 Nov., aged 53. Born in Italy, Prof. Fermi carried out many valuable experiments in that country while professor of theoretical physics at Rome. Afterwards he went to America where he was made professor of physics at the Columbia University, New York. Later he played an important role in the development of the atomic bomb, and was responsible for the first nuclear reactor built in the U.S. In 1945 he was appointed a member of the group of scientists who served as atomic advisers to the govt.

Fair Trading's Party

OFFICIAL recognition of the twenty-first anniversary of the Fair Trading Council was marked by a luncheon last week at which Lord Citrine proposed the toast of "Electrical Fair Trading Policy." He attested his personal belief in the principles of the Council for he was no exponent of unregulated competition. In 1949 they had broadmindedly accepted the idea of a nationalised industry within the framework but no one knew quite how it would work out. Commonsense and the family spirit which characterised the electrical industry had been the answer. Although at times he had misgivings whether complete fair trading was in the public interest. "We have to decide what are fair margins," he said, and there was no answer except frank disclosure. However, the Monopolies Commission he thought was not a good thing as we don't want to wash our dirty linen in public. Finally he paid a tribute to the founders of the Council and to Mr Watlington in particular.

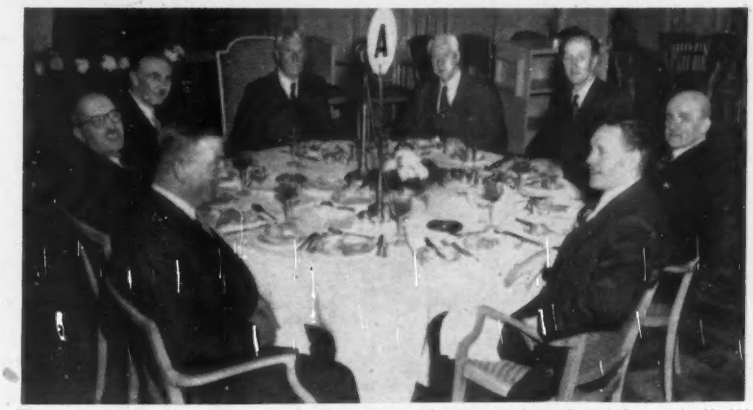
The chairman, Mr V. Watlington, in replying, said that the meeting was to be in the nature of a stocktaking for the Council's policy was part of the machinery of the industry. Originally the agreement was drawn up in quasi legal terms but he had been responsible for the adoption of a voluntary system for he believed in the faith in a common purpose. When the policy was introduced it was widely distributed and none was called upon to sign anything. It had been a success and was generally in the public interest.

The lunch was a pleasant affair with a representative gathering of distinguished guests. The vice-chairman, Mr T. W. Heather, welcomed them. Fair trading, he said, had numerous parents, was seven years begetting and had now come to the years of discretion. There was no industry where the relations between the sections were so good and fair trading had been a cementing power.

In light mood, Mr H. J. Randall responded, suggesting that area board chairmen should change places with their opposite number in industry, delivering some of the advantages not least of which would be the ability to call a profit a profit and not a surplus. Finally, a tribute to the chairman was given by Mr A. S. Lowe who said his success lay in his deep understanding.

Mr V. Watlington and Mr T. W. Heather, ponder a comment by Sir Joseph Hallsworth

Mr Victor Dale, in conversation with Lord Citrine and Mr A. S. Lowe



The "top table" group at the 21st Anniversary celebrations includes from left to right Mr W. Crisp, Sir Vincent de Ferranti, Mr T. W. Heather, Mr. V. Watlington, Lord Citrine, Mr H. J. Randall, Sir Harry Railing and Mr A. F. Plummer

NEW LITERATURE

The Inventor of the Valve

by J. T. MacGregor-Morris

COINCIDING with the Jubilee of the valve, this biography of its inventor, Sir Ambrose Fleming, has first been published in a limited edition. The author, Professor MacGregor-Morris, is particularly well qualified for the task as he was for some years assistant to Fleming. It is, of course, difficult to compress into a comparatively small volume an appreciation of Fleming's wide and diverse interests, but in this task the author has succeeded extremely well. The background against which the pioneers of electrical development performed their work and the difficulties and problems which had to be overcome are vividly described and may prove chastening to workers in this field today, when standards of measurements and accuracy of instruments are so often taken for granted.

An appendix by Arthur Blok—the substance of the 1948 Fleming Memorial Lecture—provides a lively and human picture of Fleming in his early days at University College.

The edition is limited to 1,000 copies, and the text is illustrated with reproduction of several original notes and letters, some of which have not hitherto been published. Published by the Television Society, 164 Shaftesbury Ave, W.1, 141 pages, 8½ in. by 5½ in. Price 10s.

Repair of Small Electric Motors

by K. Wilkinson

QUITE a lot has been written about the more complicated faults of the larger items of electrical machinery. They provide an interesting subject for theoretical reasoning, and the student can learn much of general importance from particular cases. Many of the things that "go wrong" with the f.h.p. motor, however, cannot be claimed to be broadly instructive, and all too often, they are maddeningly peculiar to a particular model. A book that discusses them cannot have the rounded form of an established textbook: it is rather a compendium of separate facts only tenuously connected. In consequence, it usually remains unwritten. Yet such facts can be invaluable to the electrical fitter confronted with a particular type of f.h.p. motor fault for the first time. It is a particular merit of the volume under review that it does not attempt to add a hampering veneer of theory to its practical approach to such problems. Its concern is, what may be wrong and how to put it right, and to this end it is filled not with dogmatic nostrums, but with useful suggestions moderated by the warnings of experience. It treats the small electric motor generally, but gives special attention to repulsion motors and to small electric tools. A most useful additional feature is a selection of connection diagrams for motors of named manufacturers. This book will be tested by the use to which it is put. There seems little chance, however, that by the time it is throughly soiled with workshop grease through frequent consultation on the job, its owners will be disappointed. Published by Spon, 180 pages, 8½ in. by 5½ in. Price 20s.

Electric Traction Handbook (Control)

By R. Brooks

BY far the larger part of this book deals with details of the resistance switching methods of control adopted for d.c.-powered locomotives, trolleybuses and trams. This is only natural in view of the large proportion of electric tractors which are operating on d.c. at the moment. Sufficient is provided on this subject to enable the reader to obtain a clear and accurate picture of the circuits adopted and the apparatus required to carry out the necessary switching operations, and a certain amount of information on construction is also available.

It is, however, unfortunate that the book was written at a time when little information had been published on the French 50 c/s, 25 kV experiments, as these may well revolutionise the concept of railway electrification. The section devoted to this subject is thus somewhat cursory in treatment. Similarly the chapters on diesel and gas-turbo-electric control systems might have been expanded with advantage. As far as d.c. working is concerned, the volume is well written and illustrated, and provides a comprehensive picture of modern techniques. Published by Sir Isaac Pitman and Sons, 322 pages, 5½ in. by 8½ in. Price 30s.

Data and Circuits of Television Receiver Valves

by J. Jager.

COMPANION to four other volumes in a series of books in the Philips Technical Library describing electronic valves, this work is devoted entirely to valves which, in a television receiver, must satisfy completely different requirements from those in a radio receiver. So different are the requirements that a complete range of television receiving valves is now available, from a number of manufacturers and those produced by the Philips organisation are described in this work. The book should prove to be well worth its guinea, being eminently suitable for not only designers and engineers engaged in commercial production, but for "amateur" technicians whose joy is television. Essentially, the book is in two sections, the first of which deals thoroughly with the Philips valve range. For each valve, constructional and operational details are briefly discussed, followed by an outline of its possible applications. It is then discussed more fully with respect to a number of specific circuits before setting out comprehensive data and curves relating to its performance. The second section forms a valuable conclusion, discussing important aspects of modern receiver technique of intercarrier sound and flywheel synchronisation, and ending with a description of a complete receiver circuit. Published for Philips Technical Library by Cleaver Hume, 214 pages, 9 in. by 6 in. Price 21s.

Automatic Voltage Regulators and Stabilisers

by G. N. Patchett, PH.D., B.SC., A.M.I.E.E., M.I.R.E., A.M.BRIT.I.R.E.

THE aim of this book is to provide a student or engineer who is concerned with problems associated with maintaining constant voltage a handy reference containing all the known types of regulator. For each type the principals of operation and fundamental design are discussed, although of necessity this is not too detailed and reference is made to a source from which more information may be obtained.

The book is divided roughly into three parts, the first dealing with the fundamental principles of known regulators, the second with regulators having moving parts and the final with regulators having no moving parts being composed purely of electric or electronic circuits. A knowledge of mathematics and vector analysis is required up to approximately H.N.C. standard although the treatment is not fully mathematical.

After chapters dealing with the design, classification of regulators and types of measuring and regulating units the book discusses automatic regulation using electromechanical regulating unit of the continuous control type. These include the moving coil, moving iron and induction types and the carbon pile, rocking sector and multiple contact, among others. Continuous control measuring units are dealt with in a separate chapter as are the regulating units which have the continuous control. The book winds up with a chapter on the special requirements applying mainly to generator voltage regulators. Most engineers would profit by a reading of this book, which is written in clear style amply illustrated with both photographs and sketches. Published by Pitman. 335 pages. 8¼ in. by 5¼ in. Price 50s.

BOOKS RECEIVED

Lightning Protection for Electric Systems, by E. Beck. Practical guide to supply system protection for the supply engineer discussing nature and effects of lightning. Published by McGraw-Hill, 313 pages, 9 in. by 6 in. Price 52s.

Electrical Engineering Problems with Solutions, by F. A. Benson. Comprehensive selection of problems for first-year post-intermediate students, with full solutions. Published by Spon, 232 pages, 8½ in. by 5½ in. Price 25s.

PROBLEMS AND PRACTICE

In Engineering

Bugs on the Pole

IT was with interest that I read your article "Bugs on the Board," (21 Oct. issue), and undoubtedly many maintenance electrical engineers have had similar unusual experiences where bugs, cockroaches, steamflies and rats, and others are involved, and although it seems these small creatures cause untold delays of various kinds, at times afterwards one can look back with a certain amount of amusement.

On one occasion I was called to examine a water boiler fitted with a 7·5 kW, 220 V d.c. immersion element, from which the owners were unable to get hot water. The immersion element was divided into two parts—pilot element and main element. Both parts operated through a contactor. On inspection it was found that the pilot element was in working order, and after all other normal tests had been carried out on the rest of the circuit it was observed that both the main supply and the main element were found to be in order. The pressure circuit which brings the main contactor into operation and subsequently seven-eighths of the element into service was also found to be correct and the contactor was operating perfectly, mechanically, but still the water temperature did not rise.

After switching off the current, and with a multirange test set in circuit, it was observed that if the contactor was closed by hand the main contacts did not make. The contactor was removed and on examination it was found that steam flies or cockroaches had found their way into the armature and the continual closing and opening had killed so many that a skin had been formed on the solenoid pole piece, just thick enough to prevent the main contacts from making. The face of the magnetic core was cleaned, the contactor replaced, and once again the water boiler was in perfect order.—*W. Kay.*

Rectifier Lamp

WHILST passing through an office block, my attention was drawn to a fluorescent tube. It was supplied from a d.c. source, with the conventional polarity changing switch. I was informed that it would not operate with this switch in one position, but only in the other. When switched on to the working position, only one filament lit until the tube "struck."

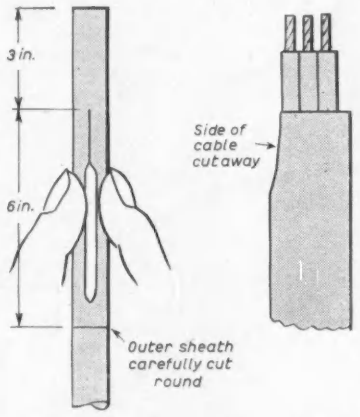
On examining the bayonet cap holder at one end of the tube I found that the wiring had been carelessly stripped and had short-circuited, with the effect that the tube had become a simple diode valve allowing current to pass through the tube in one direction only until the mercury vapour became ionized and the tube struck. It would then operate normally, the delay in de-ionization when the supply was temporarily removed during operation of the reversing switch permitting its use.—*R.T.C.*

Every engineer has a story to tell; why not tell yours on this page? We welcome contributions to this feature, and those published will be paid for at our standard rates. Problems which are encountered and overcome in day-to-day maintenance or installation of electrical plant; useful methods and techniques developed for specific jobs, or current practices, all make instructive reading for others. We will also consider for publication problems requiring an answer. Sketches are often helpful and need only be rough, as they will be redrawn before use.

Trimming p.v.c.

SALES of sheathed p.v.c. sheathed and insulated cables, in spite of recent rise in prices, are rapidly increasing for use in domestic situations. It is no wonder, since this cable possesses many superior characteristics to t.r.s. types. But in trimming the cable ends, particularly to result in a tidy job, it does present difficulties.

I have seen all sorts of contortions made and all kinds of tools, from side-cutters to pincers used, in attempts to produce a clean finish, yet more often than not the outer sheath is left exceedingly jagged as a final result. This is usually caused by attempting to trim with a knife and the latter, slipping and slithering along the outer covering, has cut into the inner insulation, with the attendant dangers of leakages, shorts and dead earths. There also appears to be enormous difficulties and physical efforts required when larger sizes, say 7/·044 gauge, and over, are used.



Left is shown method of stripping the p.v.c. sheathing from smaller cable sizes and right; that for larger sizes

My own method is to carefully circle round the outer sheath with a sharp knife at the exact place where the sheath requires to be taken off, care being taken not to let the blade penetrate the inner cores. Then, in all cable sizes up to 3/·036, I run the blade through the centre of the outer sheath, holding the knife between forefinger and thumb, as shown. Dimensions are given only as a guide. The point of the blade is inserted in the centre of the outer covering and the sheath is cut by carrying forward the knife away from the body to the cable end. This enables the cores to be gripped and when smartly pulled apart the outer sheath will tear away and is continued until the nicked circle is reached, then with a sharp stretching pull of the sheath it will come away cleanly at the nicked line and the cable will be neatly prepared without any danger of damaged insulation.

With thick outer covering as in the larger sizes and certain grades, in order to get at the cores it is easier to cut along the side of the sheath for a distance of (say) 4 in. as shown and then prise the inner cores away. Sometimes the earth wire, where integral, can be used as a rip-cord to tear the sheath. Where the sheath is especially thick or tough, and hence will not easily tear, it is necessary to cut away, along one side, half the thickness of the sheath wall, all the way from the nicked circle. The inner cores then come away as previously described. It is also suggested, that, as the technique of trimming p.v.c.s cable undoubtedly requires practice, every opportunity should be taken with odd lengths until a perfect job results automatically.—*M. N.*

Unbalanced Rotor

AN auto-synchronous motor of 100 h.p. rating and driving a compressor, developed bad vibration. The vee-belt drive to compressor was removed and the vibration located to the motor. The alignment of the motor and exciter was checked, and its bearings renewed but the vibration persisted. Finally "Megger" insulation tests were made and the readings obtained were quite satisfactory.

It was decided to strip down the motor completely. On removing the rotor it was found that one coil had short-circuited, thus causing an electrical out-of-balance. Although the coil was completely shorted, no increase in current had been shown on the ammeter, nor had the overload trip operated. Hence, although the fault current taken from the supply was not excessive, that flowing in the machine due to the fault was sufficient to disturb the mechanical balance of the rotor.—*J. Colbert.*

Equipment for Industry

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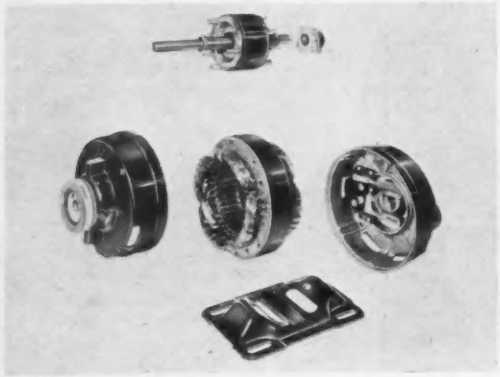
New F.H.P. Motor Range

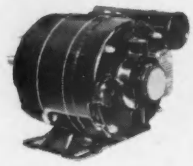
FOLLOWING the introduction of B.S. 2048, "Dimensions of F.H.P. Motors," in 1953, some measure of support for the standardised motor sizes has been achieved. Recently, the GENERAL ELECTRIC CO., LTD., Magnet Hse, Kingsway, W.C.2, announced their latest range of small motors, which conform to the recommended dimensions and, an important feature, with the exception of the flange-mounting type, they are interchangeable with motors made to N.E.M.A. Standards.

Particulars common to all sizes throughout the range are that capacitor or split-phase start is provided, and machines may be arranged for either foot or flange mounting. Bearings housed in cast-aluminium end-shields, are of the sleeve type. The steel backed white-metal lined bushes are accurately fitted and in final stage of production are diamond bored to ensure long life. Lubrication is effected by means of a felt-wick which is held in contact with the shaft by spring loading.

One of the main features of design of this range of motors has been to aim at silent running, in this connection resilient mounting is available if required and rotors are dynamically balanced as standard. Stators are riveted under high pressure to eliminate "lamination buzz"



Exploded view of new G.E.C f.h.p. motors

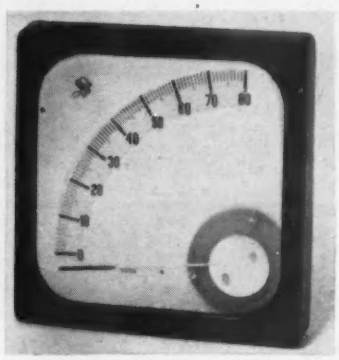


One of the new range of capacitor motors is shown here

and to ensure rigidity. Particular care has been given to the winding and insulation slots, and the double-layer insulation has special reinforcement at the ends, beyond the core. Leatheroid wedges hold the winding securely. Single contact starting switches are provided, the contacts being silver plated for long life, and actuation is by means of a centrifugal mechanism on the shaft. As an alternative to sleeve bearings, ball bearings may be supplied.

Versatile Quadrant Meter

A RECENT addition to the range of instruments manufactured by MEASURING INSTRUMENTS (PULLIN) LTD., Electrin Works, Winchester St, Acton, W.3, is the quadrant meter. Specially designed for use in situations where the interior space available in the switchboard is limited and a long scale instrument is required, the equipment is claimed to occupy no more space than that for a conventional instrument of 2 in. scale. It also projects less than an inch from the front of the panel on which it is mounted.



The Pullin quadrant meter may be used for amps or volts, a.c. or d.c.

The instrument movement gives a full sweep of 90° over a linear scale which is 7 in. in length. It may be used as an ammeter for measuring from 1 milliamp upwards or as a voltmeter, and is for use on d.c.. If a.c. operation is specified, a rectifier may be incorporated. Since the movement is in the corner of the instrument, illumination from behind can be easily achieved, and various colours of dial are available to suit customers' requirements. The case is aluminium, with a cast front section and finish is black. All instruments comply with B.S. 89, Industrial grade.

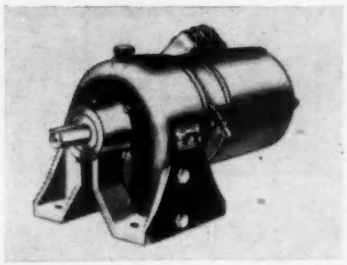
Multi-way Connectors

A NEW range of multi-way connectors giving 20, 30, 40, 60 and 80 way linkages have been developed by THE PLESSEY CO., LTD., Ilford, Essex, for use in electronic and radio applications where the unit principle is being adopted. Small and light in weight, the connectors are contained in an aluminium case, which may be removed without disturbing the connections. The plug and socket contacts are silver-plated to ensure maximum continuity and are recessed into their respective housings as a protection against mishandling.

Geared Motor Range Extended

TWO new types of foot mounting and flange mounting fractional geared motors and speed reducers are being manufactured by ELECTROPOWER GEARS LTD., Kingsbury Works, Kingsbury Rd, N.W.9. Used for all kinds of drive needing slow speed with relatively high, torque similar units are widely used on machine tools, automatic stokers and mining equipment among others. With the new types, the ESR50 and ESRV50 maximum torque is 24·6 ft lb at 12 r.p.m. Provision is made for slower speeds if required, and two-speed gearboxes are also available. The range of standard ratios is from 116·8—1 to 2·56—1.

In the gearbox—with the exception of the output shaft where ball bearings are used, phosphor bronze bush bearings are fitted, and lubrication is by splash. Four bolts secure the gearbox to the motor, which may be of the three-phase, single-phase, d.c. or variable speed commutator type, protected or totally enclosed.



One of the Electropower geared motor units—Type ESR50

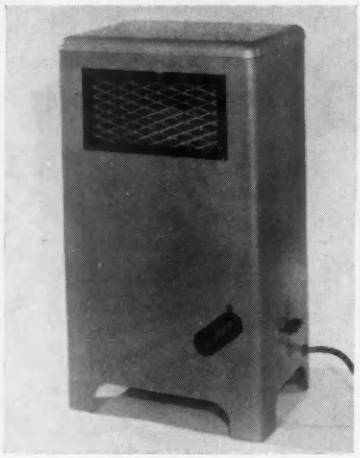
Ekco Thermotube Heaters

WE have been asked to point out that in the article on "Thermotube" heaters published in these columns last week, the blocks were transposed, and therefore the captions should have been reversed.

Carters launch "Airotherm"

MINIATURE fan heater, the Airotherm, has been introduced on the home market by the CARTER ELECTRICAL CO., LTD., Eastern Works, Romford, Essex.

A 2 kW heater which operates at half or full loading emits the heat which is circulated through the room by a built-in silent fan, the fan can operate independently of the heater for the summer months. Robustly constructed the Airotherm is finished in hammered mid bronze. It is simple to service with all parts replaceable and is fitted with TV and radio interference suppressors. Supplied for a.c. voltages 200/250 V and 100/120 V, the Airotherm will cost £12 retail inc. tax (d.c. type at slight extra cost).



Carter's Airotherm is a console type fan-heater

Hidden Alarm Mat

AN alarm mat 24 in. x 18 in. x ⅛ in. made in a bitumen felt with interior micro spring contacts and suitable for concealing under floor coverings is available from the BRITISH DISTRIBUTING CO., 391 Green Lanes, N.8.

Working from bell battery or transformer these mats are connected to a bell, buzzer or warning light to give secret warning of callers welcome or unwelcome. Their uses in small retail shops, in surgeries, waiting rooms, etc., are obvious. Only for low voltage use the mats cost 35s. each, special sizes can be made to order and bells, switches and flexible cables are available.

Two New Heaters by Falks

INCLUDED in new season's list just released by FALK STADELMANN AND CO., LTD., 91 Farringdon Rd, E.C.1, and ready in a week or so are two new heaters. First is the U.95699 "Peerless" Convector, an attractively-styled heater in hammered pewter finish, dimensions 25½ in. by 16 in. wide by 10½ in. deep. Rated 2 kW this model will sell at £10. 10s. plus £3. 17s. purchase tax. Second model is the Olympian reflector fire available in 1 and 2 kW models in hammered bronze (95708 and 9). Dimensions are 9½ in. by 12 in. by 7 in. (2 kW is 15 in. high), and prices are 1 kW £2. 10s. plus 18s. 4d. tax, and 2 kW £3. 5s. plus £1. 3s. 10d. tax. The catalogue U95664 bowl fire listed has a restyled base and is available in cream or hammered grey.

Ekco-Ensign Plastic Louvres

FOR the reasons listed below, EKCO-ENSIGN ELECTRIC LTD., 45 Essex St, W.C.2, will supply louvres made of plastic instead of the usual metal. The company claim that these semi translucent white polystyrene louvres are smarter, thinner and more permanent; they are rigid and not easily damaged, more easily produced and assembled so that there will be greatly improved delivery. The louvres will be held in place by pegs located on the Perspex sides of the diffuser, the louvre being inserted sideways and the pegs rested on the side panels. Made in trellis formation 2 in. across the diagonals of the squares, the plastic louvre due to its larger mesh and high reflection factor, has a slightly higher luminous efficiency than the metal one.

The "Jezebel" Contemporary Fire

THE styling of fires for the next generation is evident in the "Jezebel" fire which is now available from CLEVELAND ART METAL WORKS, 23 Mortimer Market, Tottenham Court Rd, W.C.1.

With a "butterfly" shape reflector in polished aluminium and body in satin brass finish the fire has a diamond mesh aluminium guard. Feet and carrying handle at rear are red or yellow. Retail prices for the 2 kW model (21 in. by 14 in. high) with switch at rear is £8. 19s. 6d. inc. tax (net trade price, £4. 14s. 3d. plus tax), and the 1 kW model (18 in. by 11¼ in. high) at £7. 3s. inc. tax (net trade £3. 18s. plus purchase tax). Delivery is ex stock.

TY add to "Mondolite" Range

NEW designs added to the "Mondolite" range of tungsten contemporary lighting fittings by TROUGHTON AND YOUNG (LIGHTING) LTD., 143 Knightsbridge, S.W.1, include the F663, 4 and 5 and F668 and 9 models which for wall mounting embody an attractively-styled shade in white satin finish flashed opal, diamond-patterned frosted glass and frosted glass with clear and applied white lines. Metalwork in some cases is finished white whilst in others it is satin brass.

For the Electrical Trade

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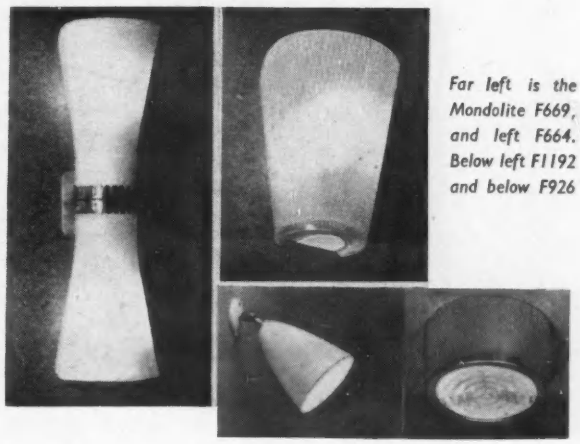
For recessing into ceiling mounting is a new range of fittings, F920, 1, 2, 5 and 6, which are finished in anodised aluminium with off-white louvres. These are useful for display work. For use with 75 W reflector spotlights a F1190, 2, 3 and 6 embody a "bullet" reflector shade in off-white with different methods of suspension. F899, a rise and fall fitting with simple counterweight in black or white has grey flexible and metal reflector in white or one of four selected colours.

TRADE PUBLICATIONS

CABLES AND EQUIPMENT.—New publication describing the range of cables, metal alloys, plastics and engineering manufactured by them has been issued by The Telegraph Construction and Maintenance Co., Ltd, Telcon Works, S.E.10.

DRY BATTERIES.—Siemens Electric Lamps and Supplies Ltd., 38-39 Upper Thames St, E.C.4, have now published an entirely new catalogue 64/54, covering their range of "Full 'o Power" and "Siemax" batteries.

RADIO EQUIPMENT.—Type GR 161 marine radio telephone equipment is described in a new leaflet by Redifon Ltd., Broomhill Rd, S.W.18.



Far left is the Mondolite F669, and left F664. Below left F1192 and below F926

NEWS OF THE WEEK

Graded Discounts on Cable Purchases

R.C.M.A. take Action on Monopolies Commission Recommendations

A NEW trading structure, providing for a graded discount, is to be introduced by the Rubber and Thermoplastic Cable Manufacturers Association on 1 Jan. next. This graded discount will be based on a customer's purchase of certain types of cable, wires and flexible cord bought from any source during the year ended 30 Sept., 1954. The existing exclusive buying and contract arrangements will cease at the end of this year and due notice to this effect, as well as an invitation to apply for grading has been despatched to all concerned. Coincidental with the introduction of new trading terms, will be the fixing of new prices. Such a review of trading arrangements was demanded by the Minister of Supply last July and the C.M.A. has decided to implement recommendations made by the Monopolies and Restrictive Practices Commission in their report on the supply of insulated electric wires and cables.

Buyers of electric cable, wires and flexible cord insulated with vulcanised rubber, synthetic rubber compounds, or with thermoplastic compounds, have been asked by the Association to state the nett trade value of their purchases during the 12 months up to last Sept., and that figure will be used as a basis for grading. Calculations on that amount will entitle the buyer to a specific discount, which will be notified to Association members and "approved wholesalers." It will apply to all purchases of C.M.A. cables, etc., invoiced during 1955.

It has also been pointed out that persons concerned with the Exclusive Buyers' Agreement will be able to claim their bonus on goods bought this year. Arrangements have also been made by the R.C.M.A. in respect of those claiming Contract Rebates where contracts may be terminated before the 12-months contract period is completed. The value of cables invoiced at the time of termination will be converted on a pro rata basis to a year's total.

Hitherto exclusive dealing arrangements have meant that a R.C.M.A. member may give wholesale terms of trade prices less a 16% discount on delivery to a wholesaler or 12½% on delivery direct to the wholesaler's customer, only to those signing an R.C.M.A. wholesaler's agreement, and in the case of the wholesaler, he must have undertaken to deal exclusively in R.C.M.A. cable. Trade terms of list price less 25% have been given to Government departments, nationalised industries, electrical contractors, and others if they have qualified electrical staff as defined by the Fair Trading Council.

1955 RADIO SHOWS

DATES have been announced for the National Radio Show and for a smaller Northern Radio Show to be held next year. Organisers are the Radio Industry Council. The National Show will take place at Earl's Court, London, between 24 Aug. and 3 Sept. A preview for overseas and other special visitors will be held on 23 Aug. In the meantime the Council is continuing to plan a smaller Northern Radio Show to be held at the City Hall, Manchester, between 4 and 14 May.

Board Engineers cope with Gales and Floods in S.W.

POWER lines and cables were among the buildings and services damaged by the gales and floods which have raged in the West Country and other parts of Britain during the past week. To cope with the emergency, the S.W. Board carried out a large-scale mobilisation of engineers and workmen and after working day and night throughout last weekend, all major faults had been repaired or alternative supplies provided before dark on Sunday. Work continued to restore supplies to small isolated groups of buildings, mostly in flooded districts. In the control room at Hayle, Cornwall, engineers carried out some 250 switching operations to restore supplies and isolate faulty sections of the h.v. network. Disaster has its recompense, however. A linesman patrolling an 11 kV line fell into a deep gulley but returned to base with a 1½ lb trout found in the flood water.

90% of Rural England will have Power in 10 Years

WITHIN eight years 90% of Yorkshire would have electricity, Sir Henry Self told the Areas Electricity Consultative Council recently when he was invited to Sheffield to give a first-hand account of the supply situation and the B.E.A.'s plans for the future. Sir Henry said that this was one target in a £130 million rural electrification plan under which 90% of the country's rural area would be supplied in ten years. By 1970, the B.E.A. would have quadrupled the amount of inherited assets, he said. A saving of 12 million tons of coal had been effected since vesting-day because of improved efficiency at power stations. Sir Henry warned that expenditure on rural electrification was unlikely to prove economic for many years, but the ultimate aim was the long-term prosperity of the country.

Charges for Supplies to Rural Premises criticised

THE practice of charging council house tenants for the installation of electricity in their homes was queried at Crediton rural council's recent meeting. It was eventually agreed to continue to charge tenants 1s. 6d. a week for the amenity of electricity including wiring. Tenants of newly-connected houses under the Rural Development Contribution Scheme will also be asked to pay a further 1s. a week to meet loan charges in respect of lump sum payments to the Board. This was also agreed.

An amendment proposed by Mr C. G. Vasey, that the matter should be deferred, was defeated. Mr Vasey said the Board was going about things in the wrong way. They should put goods in the shop window and then invite custom, he said, like the N. Devon Water Board and S. Western Gas Board. It would appear that the Electricity Board was asking customers to pay for the shop and then to pay for the things inside it.

Arising from the discussion the clerk of the council was instructed to send copies of correspondence with the Board to Mr G. Lambert, M.P. for Torrington, and to write to the Electricity Board to inquire how they calculated their charges for supplying premises in the rural district under the Rural Development Contribution Scheme.

BRUSSELS EXHIBITION

BRITAIN has accepted an invitation from the Belgian Government to take part in an international exhibition in Brussels in 1958. Object of the exhibition is to present man's social, cultural and technical progress since the war. Other countries who have accepted invitations are the Argentine, Canada, Netherlands, Norway and U.S.A. The exhibition will open in mid-April and continue until mid-October. It will take place in a parkland 4½ miles from the city centre. About 125,000 visitors a day are expected.

Cooker Sales Agreement in the Midlands

THE agreement between the Midlands Electricity Board and members of the E.C.A. in that area, anticipated in our 25 Nov. issue, was concluded just after we went to Press last week. Negotiations have been proceeding for some months now, and the results will provide for cash and credit sales of electric cookers by E.C.A. members. The Board is to supply cookers for re-sale and are prepared to finance sales on deferred terms through their credit sales scheme. Agreements between the retailer and the customer will be negotiated by the Board and all cookers sold under the scheme will be makes selected by them. Arrangements are also being made to fix the lowest possible installation charge, so that such charges will be uniform. The Board is also accepting responsibility for maintenance and for after-sales service.

Some of the larger contractors in the area of course, already sell these appliances on cash and deferred terms as attractive as those offered by the Board. At the same time those doing any appreciable credit sale business in cookers are very limited. It is the smaller contractors who will benefit most from the new agreement. Many have not been able to feature cookers because of lack of display accommodation. Customers of those thus handicapped will be afforded facilities to view a range of cookers at the nearest M.E.B. service centre. In addition the Board is providing sales literature free.

Cooker sales in the area have been rising steadily over the past five years. Total installations now amount to over 2,700 a month, or more than twice as many as were installed in April 1948—the first month after nationalisation. The new arrangement should of course, assist contractors in much the same way as it has helped retailers in Eire following the agreement reached in that country last summer. The Board will also benefit by an almost certain increase in the sale of cookers, which make an important contribution to the domestic load. At the same time the agreement, following that in the N. Western Area, will do much to improve already amicable relationships between the Boards and private contractors, and help to allay the bickerings of the less knowledgable that the nationalised bodies are exploiting their positoin and taking an unfair advantage.

— OFFICIAL PUBLICATIONS —

E.R.A. REPORTS.

L/T294: Some Experiments on d.c. positive Point-to-Plane Corona Discharges, by H. M. Gaunt and J. D. Craggs, 15s. 3d.; L/T298: Review of Ferroelectricity and Antiferroelectricity in the Perovskites, by A. F. Devonshire, 10s. 6d.; L/T301: Negative Ion Formation in Gases of High Dielectric Strength, by J. W. Marriott and J. D. Craggs, 24s. 4d.; L/T302: Dielectric Properties of Ketone Resins, by E. Rushton, 12s. 9d.; L/T308: Negative Ion Formation in Gases of High Dielectric Strength, Part II—The Lozier Apparatus, by J. W. Marriott and J. D. Craggs, 15s. 3d. L/T309: Water Sorption in Polystyrene and Cellulose Triacetate, by A. G. Day, 12s. 10d.; O/T12: Deposits on Overhead Line Insulators Exposed to Wind-borne Salt Spray, by G. Mole, 12s. 3d.—Available from Assoc. at Thorncroft Manor, Dorking Rd, Leatherhead, Surrey.

AIR POLLUTION. Report of Committee under chairmanship of Sir Hugh Beaver. Command Paper 9322. (see page 811). HMSO. 2s. 6d.

3-POLE CIRCUIT-BREAKERS, CIRCUIT INTERRUPTORS AND SAFETY SWITCHES. U.S. Case Study Data issued by Foreign Operations Administration and distributed by British Inst. of Management, 5s.

ELECTRICITY REORGANISATION (SCOTLAND) ACT 1954. Published in final form. HMSO. 1s.

NUCLEAR POWER COSTS

ESTIMATES of the cost of nuclear power generation in Great Britain have surprised the scientists concerned: it is now expected to be approximately equal to the present cost of generating electricity with conventional fuels. This was stated by Dr J. V. Dunworth, head of the reactor physics division at Harwell in a lecture delivered in Birmingham last Saturday. He claimed that costs for the Calder Hall power station now being built were known to within 10%. Dr Dunsworth expressed great confidence in his prediction, but called for caution in embarking on any large scale programme of building nuclear power stations.

Wholesaler Expands

VISITORS to the Hammersmith branch of the Wholesale Fittings Co., Ltd., may not easily recognise the new and enlarged premises in King St. The company has recently acquired the adjoining building and the branch is now twice its former size. The showroom occupies the entire first floor and the company is able to carry a much larger stock.

Hospitals ask for Special Tariff

A REQUEST that hospitals should be supplied with electricity on a preferential tariff was considered at a recent meeting of the Southern Electricity Consultative Council. The matter arose from a letter received from the West Wiltshire Hospital Management Committee who complained of the high cost of electricity supplied to hospitals and who asked for a special tariff. It was reported at the meeting that the Committee's request had been referred to the Board at Newbury who showed that hospitals in that district at least received power on very favourable terms. The fear was expressed that once the practice of granting preferential rates was started there was no knowing where it might end. Readers will no doubt recall the urgent appeals which have been made in respect of churches. The Council agreed to take no action.

Wiltshire Firm opens New Showrooms at Chippenham

ALTHOUGH no plans have yet been made for the official celebration of their silver jubilee next year, Bulson Bros. Ltd. have anticipated the event by the opening of modern new showrooms in New Rd, Chippenham. The new premises were formerly a private house. The ground floor was lowered 2 ft to bring the floor level with the pavement; bedrooms on the first floor have been converted into offices and further display rooms; and lawns and gardens in the rear have been turned into stores and service departments. The front of the building forms a small arcade which is topped by an impressive illuminated fascia. Thus the New Rd building becomes the company's new head office.

Bulsons started in the dark days of 1930, but has grown into one of the most prominent electrical companies in Wiltshire. They have branches in Station Hill, Chippenham, opened in 1934, at 59 Church St, Colne, opened in 1936, and at 42 Market Place, Devizes, which was opened in 1939.

Bulson's new headquarters in New Rd, Chippenham

Simpler Tariffs wanted by Chamber of Commerce

OVER a dozen proposals have been included in a memorandum compiled by the Association of British Chambers of Commerce and submitted to the Committee of Enquiry into the Electricity Supply Industry. The list of recommendations is headed by a call for simpler tariffs for industrial and commercial consumers and charges which would be common to all areas. It is also suggested that the charges are too high, especially in view of the B.E.A.'s profits at the end of 1953. A tariffs advisory committee to consider how far actual tariffs conformed with certain principles in relation to the costs of supply, is also recommended, as is a wider availability of off-peak charges which would encourage the use of electricity outside peak hours.

The proposals then turn to the structure of the industry. The Association suggests that each Area Board Chairman should have a seat on the Board of the Central Authority, primarily, it is stated, to have greater control over the costs of generation. Better representation of the various classes of consumers on Consultative Councils is urged. This representation should be based on the amount of electricity consumed. Consultative Councils come in for a deal of criticism in the memorandum. The Association asks that Council chairmen and secretaries be paid by the Ministry of Fuel and Power and not by the Boards, so that they may be more impartial. In addition a Central Electricity Consultative Council is proposed, empowered to consider matters relating to the generation of electricity and its cost.

Representatives of the Association are expected to attend before the Committee to support the proposals made.

Refrigerator a Necessity—Appeal to reduce P.T.

THERE have been a number of suggestions that the washing machine has now become a necessity rather than a luxury in the home and should in consequence be relieved of the purchase tax imposed on it. The same opinion has now been advanced in respect of the domestic refrigerator. The Midlands Electricity Consultative Council has decided to write to the Chancellor of the Exchequer and to local M.P.s urging a reduction in the tax. Such representations were apparently suggested by the E.D.A. and were approved on a motion of Capt L. R. Hibbert who said refrigerators should no longer be regarded as luxuries. They had become necessities and as such should not to be taxed at the present rate.

The high cost of collecting consumers' accounts and reading meters in the Area was also referred to at the Council's recent meeting. Reviewing the Board's annual accounts, the Council's chairman described as staggering the expenditure of £750,000 on such items. Clr H. Clowes said much of the expense of meter-reading was caused by fruitless collectors' journeys when householders were away. He suggested that meters placed outside houses, as in the U.S., would probably reduce expenditure in this field.

Coseley's Lights Switched On

THE new street lighting scheme at Coseley on the Birmingham-Wolverhampton Rd have now been switched on. The scheme covers about 3½ miles, comprising 340 fittings suspended in pairs on steel catenary wires and supported by 25 ft steel columns. Details were given in our issue of 4 Nov. The lighting units were installed by Revo Electric Co., Ltd., and the cable laying and services were provided by the Midlands Board. The stretch of road has been described as one of the best lit in the country.

FIREMEN'S REPORT ON DALMARNOCK EXPLOSION

SERIOUS fires followed the short-circuits which put Dalmarnock power station out of action in February of this year. The story of the incident from the fire-fighting viewpoint is told in the latest number of the *F.P.A. Journal*, which is published by the Fire Protection Association, 15 Queen St, London, E.C.4. The first explosion, it is stated, broke most of the windows in the switchroom concerned, and the inrush of air that followed assisted the rapid spread of fire in the oil which escaped from the switches. Fire spread to the storey below along the bituminous insulation of busbars passing through the floor. The switchroom in which an explosion occurred on the second day is on the same level as that concerned on the first day, but is separated from it by a control room. The second explosion was less intense because the short-circuit level was much reduced; as a consequence, no windows were broken, and the room became smoke-logged and its temperature was extremely high. In general, however, damage was much less.

Various other fires of electrical interest are described in the publication, including one caused by the use of a 60 W lamp as a bed warmer!

WHOLESALERS' A.G.M.

IT WAS announced last week that the annual general meeting of the Electrical Wholesalers Federation will take place at the Waldorf Hotel, London, on 17 Mar. next. The Federation's annual dinner will be held at the Dorchester Hotel, the same evening.

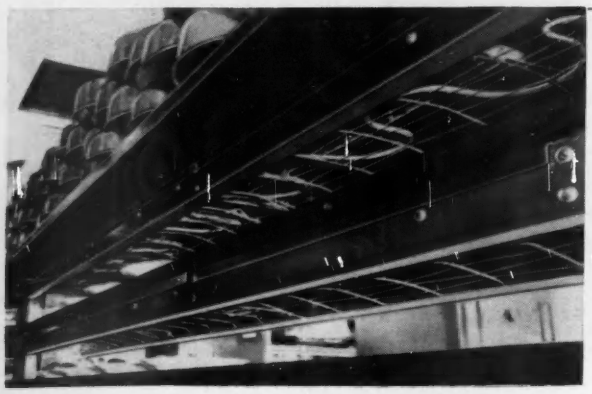
Infra-Red Elements to keep Food Hot

INFRA-RED tubular elements have been used in two large London restaurants to maintain hot-food temperatures. Hitherto counters have been electrically or steam heated but this has not always proved completely satisfactory especially where there is a multiple system of shelving. The infra-red system has been adopted at the Oxford St and Strand Corner Houses of J. Lyons and Co., Ltd., and was provided by Metropolitan-Vickers Electrical Co., Ltd.

In Oxford St. the self-service counter has the elements installed beneath the two upper shelves, thus radiating heat on to the food below before customers take it away. In the Strand, the same system has been employed although in this case it is a waitress service.

The Metrovick tubular element is made by inserting a magnesium tube of 99·9% minimum purity into an outer sheath of non-scaling non-corroding alloy, and introducing within the magnesium tube a helical coil of the highest grade heat-resisting wire. The magnesium is then converted into solidly packed magnesium oxide. Additional treatment is given to the element surface to ensure uniform radiation. This method of construction ensures perfect centralisation, an even thickness of insulation and uniform spacing of the spiral.

The elements can be supplied in standard or special lengths to suit customers' requirements. Of importance too is the fact that the smooth outer sheath can easily be kept clean and there is no fear of chipping and consequent contamination of food. The element is designed to operate up to a surface temperature of 750° C. and the heat is simply controlled.



Close-up view of Metrovick's infra-red tubular elements installed in the waitress service counter at the Strand Corner House in London to keep plates of food hot

E.A.W. presents Prizes in Kitchen Planning Contest

PRESENTATION of prizes in the E.A.W.'s Kitchen Re-planning Competition took place at the Lighting Service Bureau in London last Thursday. The competition has been running over the past six months and was open to all members of the Association. Candidates were required to replan either a working kitchen or a dining kitchen. Prizes took the form of vouchers which had to be spent on electrical equipment. The first was valued at £25 and won by Mrs J. B. Harvey, who is joint hon. secretary of the Newcastle, Staffs, branch, and who proposed to buy a Kenwood Chef food mixer. There were six other prizes valued at £5 each. A total of 318 entries were received, comprising 191 for a replanned working kitchen and 127 for the dining kitchen. Special prizes were also given to entrants from schools affiliated to the Association.

The presentation was made by Lady Swaythling. Afterwards, one of the judges, Mr A. L. Osborne, F.R.I.B.A., gave a talk on kitchen planning and referred especially to points arising from the competition. Among the improvements he advocated were more accessible ovens and refrigerators, possibly waist-high and built in, and more room on the hotplates. He expressed disappointment that manufacturers had shown little or no inclination to accept suggestions made following practical research in the kitchen.

PRICING CABBAGES

A YORKSHIRE consumer has written to the Consultative Council complaining about the method of charging for electricity according to floor area. The writer stated: "When I buy a cabbage, I am charged according to weight, size or quality, but not according to the size of the kitchen in which it is cooked."

The First Half-Century

The maximum demand system is a puzzle which the average consumer is seldom able to solve. In Hackney the Borough Council has decided to adopt the maximum demand system of charging, and consumers have been asking Mr L. L. Robinson, the borough electrical engineer, for help. Mr Robinson in response to these appeals has got out a letter setting forth a very simple method whereby the average price per unit for any class of supply can be easily worked out by the layman; who will then be able to judge for himself whether he had better stick to the flat rate of 4d. per unit or go on the maximum rate of 7d. and 1d. This, of course, all depends on the number of hours the light is in use. For the one hour only the flat rate is much the lower, for two hours the price unit is the same, but for more than two hours the maximum demand rates are far and away the easier.—*From our issue of 1st December*, 1904.

Yorkshire Board's stand at the Civic and Trades Exhibition held in the City Hall, Kingston-upon-Hull, once again drew attention to the Four Foundations of Modern Living. Cookery demonstrations attracted good audiences. Attendance at the exhibition was about 23,000

SOCIAL EVENTS

Annual Dinners in the Provinces

THIS is the season for social functions and it is unfortunate that the events are far too numerous to report fully. Among association dinners held recently was that of the Electrical Trades' Commercial Travellers' Association at the Queen's Hotel, Birmingham. In proposing the toast of the association, branch chairman, Mr R. Capel (Fosters Elec.), expressed his hopes for the organisation's expansion to other parts of the country and the need for new members. Mr T. B. O. Kerr (G.E.C.) the president, replied. Among the guests were Mr H. M. Fricke (president, Birmingham Electric Club), and Mr J. W. Johnson (Birmingham branch chairman of E.C.A.). Over 150 members and guests were present.

A warning that engineers should not become engrossed solely in engineering to the exclusion of administrative and managerial aspects of the job, was given by Mr A. N. Irens, (chief electrical engineer, of Bristol Aeroplane Co.), at the annual dinner in Bristol of the E.P.E.A.'s Western section. He said engineers did not pay enough attention to administrative aspects and tended to think the engineering aspect was adequate. Mr Irens was proposing the toast of the Association, and his views were echoed by Mr E. Hanson, president, who replied.

This year the ladies were invited to the second annual dinner of the Suffolk Electricity branch of N.A.L.G.O., held in Ipswich. They were among about 100 who heard Mr J. Pepper, vice-president of N.A.L.G.O. and establishment officer of the E. Midlands Board, call for more active recruiting for members. He noted a 7% reduction in membership of the Suffolk branch. Other speakers included Mr F. S. Grindrod, president of the branch and dep. chief accountant with the Eastern Board, Mr C. T. Melling, chairman of the Board, and Mr P. Sydney, the Board's Suffolk sub-area manager.

Guest of honour at Exeter Electric Club's fourth annual dinner was Mr R. B. Wildsmith, director of E.W.F. Also on the toast list were the Club's president, Mr G. Stewart Mogridge, its vice-president Mr H. F. G. Bicker, and the chairman of Plymouth's Electric Club, Mr F. C. Isaac.

Total amount raised at the third annual buffet dance of the W. Lancs, Merseyside and N. Wales branch of E.I.B.A. was £90. Some 150 guests attended this function which took place at the Hotel Victoria, New Brighton.

The Hastings and Bexhill branches of the E.C.A. joined their colleagues at Eastbourne for their annual dinner and dance at the Queen's Hotel. Among the civic guests were the Mayor and Mayoress of both Eastbourne and Bexhill and the deputy mayor of Hastings. Mr E. S. Parris, chairman of the Eastbourne branch presided.

Eastern Board's Record

THE Eastern Electricity Board have announced that during Oct. they connected 6,276 new consumers. This was the highest total for any one month since the Board's inception in 1948. Previous record was 6,162 connected during Nov. 1953. Last October's figure includes 147 farms, emphasising the Board's strenuous efforts to take electricity to as many rural premises as possible.

TV Nearer for Those in North-East Scotland

FULL programme service from Redmoss, near Aberdeen, will start on 14 Dec. In the meantime regular test transmissions are taking place to enable the radio trade to install and adjust TV receivers and aerials. Good progress is reported on the new medium power television station for N.E. Scotland known as Meldrum and situated about 20 miles from Aberdeen. This is expected to be completed towards the end of 1955. The B.B.C. is building a temporary station and have installed low power vision and sound transmitters in a mobile building, and a temporary mast and aerial have been erected at the Reamoss sound station. Eventual service will cover the whole of Kincardine, and parts of Moray, Banffshire and Aberdeenshire, north-east of a line between Burghead and Brechin and Montrose. The stations will operate on channel 4—vision 61·75 Mc/s and sound 58·25 Mc/s.

NEWS IN BRIEF

The Story of Petroleum will be the subject of this year's series of Christmas lectures arranged by the Royal Institution. The speaker will be Air Commodore Sir Frank Whittle and dates to note are 28 and 30 Dec. and 1, 4, 6, and 8 Jan.

The Merite Culinaire has been won for the first time at the Scottish Hotel School, Glasgow, by Miss Linda Wilson. The medal is to be presented annually with a 10 guinea cash prize, by the chairman and directors of Jackson Electric Stove Co., Ltd.

A new branch of E.A.W. has now been formed at Chesterfield. Chairman is Mrs F. Hadfield, ex-Mayoress, and hon. secretary is Mrs Deakin.

This year's dinner and dance for the Southern England staff of B.I.C.C. was held at the Royal Festival Hall in London. Over 1,100 were present. A similar function took place at the Casino, Blackpool, for northern staff a short time ago.

For the first time in Britain, a joint exhibition of chemical plant and petroleum equipment is to be held at Olympia in June 1958. Known as the Chemical and Petroleum Engineering Exhibition it will be organised by F. W. Bridges and Sons and sponsored by the British Chemical Plant Manufacturers Association, and the Council of British Manufacturers of Petroleum Equipment.

Electrical equipment for auxiliary drives of a combined universal beam and heavy section mill for the new Lockenby steelworks will be supplied by the G.E.C. A £250,000 contract has been placed with them by Dorman Long (Steel) Ltd.

New exhibitors at Birmingham Engineering Centre include J. Burns Ltd., Fibreglass Ltd., Gledhill-Brook Time Recorders, New Wellbeck Ltd., Sangamo Weston Ltd., Solartron Electronic Group Ltd., and Walterisation Co., Ltd.

Brook Motors Corpn. of Chicago, the American company of Brook Motors Ltd., are exhibiting at the National Power Show which opens in Philadelphia today (2 Dec.).

Speaking at the Home Safety Session of the National Conference on Safety, Mr A. C. Hazel, managing director of Hurseal, Ltd., said electricity could be a completely safe heating medium provided totally enclosed appliances were used with a low surface temperature. Electrical appliances and the electric fire were strongly criticised.

A special shop within a shop has been opened at the Jackson Furniture Store in Glasgow. Thirty-six compartments in egg-crate fixtures feature G.E.C. electrical appliances. There are also displays of refrigerators, lighting fittings and kitchen equipment.

Correct installation of electric water heating appliances and particularly the immersion heater in modern housing, was the subject of a talk by E.D.A.'s Mr P. Honey to the Luton Council of the Registered Plumbers' Association.

Long Service Assoc. of Metropolitan-Vickers Electrical held their annual social at the company's Trafford Park works recently. About 1,100 members sat down to dinner in one of the staff canteens. Viscount Chandos is the new president.

Travellers Stag Party

ANNUAL stag party, dinner and smoker of the Electrical Trades' Commercial Travellers' Assoc., will be held at the Windsor Castle (Victoria Station), London, S.W.1, on 17 Dec. Tickets are priced at 16s. 6d. each and may be had from Mr L. A. Fickling, c/o Linolite Ltd, 118 Baker St, W.1.

Development in Diesel Design

DESPITE the challenge from the gas turbine, popularity of the diesel engine continues to soar and up to 5,000 h.p. its future is assured. Therefore research into ways of improving fuel consumption, efficiency and reliability of compression ignition engines is being carried on at great pace. This was made clear in paper entitled "Current trends in Diesel Engine Development" presented by Mr R. W. Stuart Mitchell, Chief Development engineer, diesel engine division of the English Electric Co., Ltd. Concentration on the problems had led to increased attention being paid to using higher boost pressures than hitherto, employing turbo-charging methods. This applied alike to both two and four stroke engines. Apart from considerations affecting basic design, improvements on components such as pistons, piston rings and bearings are also being sought. In this connection it is interesting to note that a return to cast iron pistons may be contemplated.

QUESTIONS IN PARLIAMENT

Building Power Stations

DETAILS of existing arrangements for the construction of power stations were sought by Mr S. Hastings last week. He was told by Mr L. W. Joynson-Hicks that 42 power stations were being built and 18 of these were in urban areas and 24 in rural. In addition 11 stations were being planned, 3 in urban and 8 in rural areas.

Trade Mission to China

THE President of the Board of Trade last week gave some explanatory facts to Mr A. W. Lewis concerning the British trade mission now visiting China. He declined to give the names and businesses of those in the party (electrical concerns included were named in our 11 Nov. issue). He said, however, that the visit had the Government's approval although, of course, there was no question of the party negotiating trade agreements on behalf of the Government. It was to be hoped, the Minister added, that satisfactory business would ensue within the scope of existing controls.

Overseas Purchases by Public Co's.

PURCHASES of capital plant outside this country by nationalised industries caused some concern to Mr G. Nabarro. He drew particular attention to the N.C.B.'s buying £500,000 of colliery equipment from Germany in spite of competitive British tenders and urged that the nationalised industries should buy British. Mr R. A. Butler said that the nationalised concerns were guided by their own commercial considerations subject only to restrictions as regards balance of payments. Mr Nabarro rose again however to say that the foreigner believed that the policy of the industries was inspired by the Government, and in consequence British industrial prestige was being undermined. The Chancellor considered this an exaggeration of the extent of purchases. Preference should be given to British goods, he said, but there were many matters to be considered.

St. Lawrence Seaway

AT present only one contract had been offered for the St. Lawrence Seaway project and that had been awarded to a Canadian firm, the Chancellor of the Exchequer told Mr J. Grimond last week. He said permission had been given to a number of British concerns to establish subsidiaries in Canada and doubtless they would submit tenders as and when they were invited.

Thanet Railway Electrification

PRIORITY for the electrification of Thanet railways in the Southern Region was sought by Mr W. R. Rees-Davies, but the Minister of Transport again reminded the House of Commons of proposed statement concerning plans for the modernisation and re-equipment of railways.

Lighted Signs

THE matter of illuminated signs was raised in the House last week by Lt-Col Bromley-Davenport. He drew attention to the fact that under present regulations red fluorescent tubing signs inside a hotel appeared to come within the control. The Minister of Housing explained that provided the sign was not visible outside, there were no restrictions on signs in buildings.

ELECTRIC SUPPLY NEWS

Agecroft

The B.E.A.'s proposals to extend Agecroft power station are being opposed by the Salford and the Swinton and Pendlebury Councils.

Belfast

A report on district heating from power stations is to be submitted to Belfast Corporation Electricity Committee by the city electrical engineer. At a recent meeting of the committee, Alderman Scott, the Deputy Lord Mayor, raised the question of district heating and suggested the appointment of a subcommittee to consider the matter.

An official of the committee has been instructed to examine the district heating system operated from Battersea power station the next time he is in London.

Drakelow

The commissioning of this new generating station has been delayed three months by a shortage of vital mechanical components, it has been stated. This station is to have four 60 MW turbo-alternators, and four 515 k lb/hr boilers. It is now hoped to have the first machine operating early next year.

Fort Augustus

Claimed to be the highest, remotest, most inaccessible and most difficult transmission line construction job which has been done in the British Isles—the erection of 132 kV line over the Corrieyaraick Pass between Fort Augustus and Speyside, has been completed and was recently officially inaugurated by the North of Scotland Hydro-Electric Board. The pylon at the summit of the Pass is 2,600 ft above sea level. The line consists of 25 miles of double circuit line carried on 138 steel towers which have special heavy foundations because of the exposed route along which they stand. Estimated cost of the scheme is £450,000. The line was erected by the J. L. Eve Construction Co., the electrical consulting engineers being Merz and McLellan. At the switching-on ceremony, Mr T. Lawrie, general manager of the Board, paid tribute to those involved in the erection of the line. Among other work in hand by the Board was the line running north from Lairg to Cainthness to supply power to farmlands there and to Thurso, Wick and the North Sutherland coast. In the west, owing to the growing demands of Skye and the Kyle and Lochcarron district, it would be necessary to build a 33 kV line from the Fannich scheme. For main transmission 132 kV used to be the highest voltage, but a future main transmission line from Beauly to Aberdeenshire operating at 275 kV was being considered, he added.

Leeds

A survey around Skelton Grange started 12 months before the power station went into commission had revealed no measurable increase in dust deposits or sulphur dioxide contamination since the station began operations, although coal consumption was now approaching 20,000 tons per week, it was reported at a meeting of the area Electricity Consultative Council. Those results were confirmed by the testing stations controlled by the Medical Officer of Health for Leeds, it was stated. A letter from the Yorkshire Division of the B.E.A. explained that over £250,000 had been spent at Kirkstall in replacing grit arresters and on a 350-ft concrete chimney to replace the six chimneys for No. 1 and No. 2 boiler houses. A second 350-ft chimney to replace the remaining six 200 ft chimneys was being built at a cost of £120,000. Those modifications would ensure that at no place was there a concentration of dust or gases that would create a nuisance.

Lewisham

Unless a new electricity substation was erected and brought into use at the earliest possible moment, parts of the South London borough of Lewisham would be blacked out in a few years, said Mr F. S. Fay at a Ministry of Housing and Local Government public inquiry at Lewisham Town Hall. The London Electricity Board were applying for the second time in two years for permission to build a substation on a site adjoining the railway station in Sydenham Park. The site, at present owned by Lewisham Council, is used as allotments. The first application, made in 1952, was refused. Mr Fay said an urgent situation had arisen because the Catford station would not be able to cope with increasing demands. Electricity supply was taken from a 66 kV cable which ran under Sydenham Park, making the site asked for the only one to meet technical requirements. The Board proposed to erect an oblong building at a cost of £750,000.

The London County Council objected because the land was zoned for allotments of which there was a shortage in London. Lewisham Borough objected because they wanted the site for housing. According to Mr Fay, these objections would be met by the Board by buying an adjoining site and offering to sell it to the councils for their schemes.

Marchwood

This new power station would probably come into commission towards the end of next year with its first 60 MW set, Mr A. D. Matthews, the recently-appointed station superintendent, has told the local Regional Board for Industry. He had no doubt that Marchwood would not only become a very efficient generating station, but also a large training centre for technical and clerical staff and craftsmen. He went on to explain that, in anticipation of the difficulty of obtaining craftsmen for Marchwood, the Authority started two years ago taking on at the Southampton generating station additional apprentices, not only to meet the requirements of the present station, which would still be run for some years yet, but so that some could be transferred to complete their apprenticeship at Marchwood.

North of Scotland

Orders for additional generating plant for the Carolina Port, Dundee, power station, have been placed by the North of Scotland Hydro-Electric Board. The new plant will consist of two 150 k lb/hr boilers, ancillary equipment and a 30 MW steam turbo-alternator which will replace three 6,000 kW low pressure machines and boilers which were old, obsolete and heavy on coal. John Brown Land Boilers Ltd. are to supply the two new boilers and the English Electric Co. Ltd. the turbo-alternator together with the main and auxiliary transformers. Part of this equipment will be built for the English Electric Co. by Harland and Wolff at their Scotstoun works.

Sayings OF THE WEEK

"Support the private trader wherever you can. He is the man who does most good for the local community in which he lives." . . . MR A. APPS, speaking at the dinner of the Hastings and Bexhill branch of the E.C.A.

"If any of you are afraid there may be some hazards in the nuclear fission industry, I can only point to Harwell, which has probably the finest birth-rate in the country.". . . SIR JOHN COCKROFT, speaking at the annual dinner of the Electrical Power Engineers' Association last Friday.

"I am at loss to understand why such fabulous prices are being asked for 'contemporary' lampshades which, although sometimes fascinating and often pleasing, are only made of paper." . . . BARBARA COHEN, writing to the *Evening Standard*.

LIGHTING SCHEMES

Abram. The U.D.C. is to provide sodium lighting along Warrington Rd, at a cost of £5,064.

Edinburgh. A scheme has been approved in principle for the conversion from gas to electricity of street lighting.

Folkestone. T. C. to invite tenders for carrying out three street lighting schemes, estimated to cost £4,000.

Stalybridge. Plans have been prepared for second stage of street lighting conversion, estimated to cost £4,300.

COMPANY ACTIVITIES

THE colour problem in Rhodesia, although apparently far removed from the electrical manufacturing industry, may be a factor before long. Northern Rhodesia produces about one-eighth of the world's copper. They are up against the problem of getting white workers to accept black workers in higher status jobs than they are allowed to hold now. In his annual statement to Mufulira and Roan Antelope shareholders, Mr R. L. Prain, the chairman, stated "I regard the issue of African advancement on the mines as the most serious single problem still to be solved, and I do not believe we can look forward to the certainty of a period of full production, industrial peace and economic progress until it is so." In his view the African employees are entitled to feel that there is no impediment to the satisfaction of their reasonable aspirations. On the other hand he feels that the European employees are entitled to reasonable safeguards.

At the moment the employers seem to be divided. The Rhodesian Selection Trust group has given notice to terminate the agreement which has prevented the advancement of the African into the field of European employment. That at least seems likely to bring matters to a head as far as that group is concerned. But the Anglo-American Corporation group has declined to terminate the agreement. Each will now doubtless strive to prove that their method is the best and between the two there may be a solution. If it comes to a strike the European workers are in a strong position. But the position of the African is less happy. It would mean a virtual closing down, with the companies forced to look after the Africans.

As far as our industry is concerned, a strike would probably force the price of copper up again, as during the American and Chilean strikes recently. There are also difficulties in connection with the railways, which in the opinion of the copper bosses have not been developed as they should have been to deal with increasing flow of copper and fuel.

Sterling Electric Holdings is still struggling. Results for the year to March last show a group loss before tax of £20,023 as against £14,977. Overdraft goes up from £139,000 to £199,000. The poor results this time are due in the main to a fall in the sales in the diesel-engine company, Russell Newbery and Co., as a result of the suspension of Government contracts—a suspension not provided for in the contract. Says chairman, Sir Albert Braithwaite, "we now have in hand the appropriate claims under the break clause." Last year the company was in difficulties owing to the serious restriction of imports of domestic electrical equipment by many countries. We look forward to the chairman's statement about the company's sub-machine gun which, he stated last May, has been adopted by the Government after extensive and satisfactory troop trials.—*From our City Correspondent.*

Brook Motors Ltd.

With the present rate of demand for the company's manufactures, only a short time will elapse before a new record is obtained, Mr Frank V. Brook, the chairman, reports. The present premises cannot adequately meet the planned production increases, and additional accommodation will shortly be required to meet the increased f.h.p. motor demand. Higher material and labour costs have been absorbed, without raising selling prices, by careful changes in production mehods, he adds.

Year to 30 Sept.	£ Trading Profit	£ Net Profit	% on Ord. Earned	% on Ord. Paid	Ord. Price High	Ord. Price Low
1950	388,333	148,050	61	17½	—	—
1951	560,769	219,870	95	20	38/6	32/6
1952	762,790	242,206	105	20	34/3	28/–
1953	514,359	107,495	36	20*	37/3	27/10
1954	595,594	227,738	71	20†	47/–	29/1

* Plus 16⅔% capital bonus. † Plus 14⅓% capital bonus.

Crabtree Electrical Industries Ltd.

The improvement in profits is clearly reflected in our accompanying table. The full accounts lists current assets totalling £1,050,315, compared with £1,047,229 a year ago, the advance being due to an increase in sundry debtors, and cash at bank and in hand. The value of stock in trade, work in progress and tools, dropped by over £120,000, which is probably due to a reduction in raw materials stocked made possible by the improved supply position.

Year to 31 July	£ Trading Profit	£ Net Profit	% on Ord. Earned	% on Ord. Paid	Ord. Price High	Ord. Price Low
1950	368,757	135,939	38	17½	39/9	32/–
1951	458,922	154,861	46	17½	44/3	33/9
1952	357,244	111,983	33	17½	36/–	30/–
1953	241,076	65,601	17	17½	32/6	23/9
1954	288,075	93,879	25	20	29/9	23/9

Dewhurst and Partner

For the year ended 30 Sept. last, the profit, after taxation, is £73,433, compared with £46,102, a year ago. The final dividend is 20%, raising the total distribution to 24% (*19%*).

Dictograph Telephones Ltd.

The general home trade has shown an improvement on the previous year, and it is from this source that the company's main income is derived, Mr P. V. Summer, the chairman, states. In the export trade also there was a considerable increase over the previous year. This has been aided by the removal or modification of some restrictions in certain countries, but he gives warning of an indication of difficult export conditions.

Laurence Scott and Electromotors Ltd.

The directors announce a scrip issue comprising one new "A" Ordinary share for each "A" and "B" Ordinary share held. A meeting is called for 15 Dec. to capitalise £441,095.

Rawlings Bros. Ltd.

The group trading profit, etc., for the year ended 31 Mar. last is £40,281 compared with £34,392 for the previous year. The net profit is £6,987 (*£1,202*). The dividend is again 7½%.

Siemens Bros. and Co.

The board states that negotiations are in progress with Associated Electrical Industries Ltd., who are expected to make an offer for the Siemens' Ordinary stock.

Solus, Teoranta

This Irish electric lamp-making concern reports a substantial increase in sales during the year ended 30 June last, and, with the exception of one week, the factory was kept going throughout the year. The chairman, Mr M. W. O'Reilly, states that no progress was made in securing suitable machinery for the manufacture of glass bulbs, but they had been able to make a start in the establishment of a department to enable the production of fluorescent lighting tubes and to further development of the neon dept.

Year to 30 June	£ Trading Profit	£ Net Profit	% on Ord. Earned	% on Ord. Paid	Ord. Price High	Ord. Price Low
1950	22,202	7,184	11	10	35/–	33/–
1951	30,292	11,829	17	12½	40/–	30/–
1952	36,605	10,747	16	12½	39/–	30/6
1953	38,368	11,407	18	12½	34/–	32/–
1954	43,549	13,559	22	12½	37/6	36/–

Sun Electrical Co. Ltd.

Despite a small increase in the volume of sales, a decrease in prices and increased competition was responsible for the reduction in profits, the directors report. But with intensified sales promotion a considerably increased volume of sales has been achieved to date compared with the corresponding period last year.

Year to 30 Apr.	£ Trading Profit	£ Net Profit	% on Ord. Earned	% on Ord. Piad	Ord. Price High	Ord. Price Low
1950	89,374	27,184	43	10	23/7	20/6
1951	132,757	44,249	80	15	25/6	20/–
1952	113,545	33,057	57	15	26/–	25/6
1953	101,742	30,415	49	15	27/–	24/6
1954	85,710	23,392	27	15	35/6	28/6

Dividends Declared

Hackbridge and Hewittic Electric Co. Interim 7½%.

Oriental Telephone and Electric Co. Interim of 4% (*same*).

Lisbon Electric Tramways. Interim of 2½% (*same*).

London Electrical and General Trust. Interim of 4% (*same*).

Oldham and Son. Interim of 7½% (*same*).

Johnson, Matthey and Co. Interim of 3% (*same*) on capital trebled by scrip issue.

Louis G. Ford Ltd. Interim of 5% (*10%*) on trebled capital.

COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

3 Dec.—Connah's Quay U.D.C. Class A concrete columns and sodium lamps, etc. —Advertised in 18 Nov. issue.

3 Dec.—Doncaster R.D.C. Group A sodium street lighting units at Warmsworth.—See 25 Nov. issue.

3 Dec.—Dublin T.C. 14,000 yds of flex for public lighting.—See 18 Nov. issue.

3 Dec.—Fifeshire. Installations at Starley Hall, Burntisland.—See 25 Nov. issue.

3 Dec.—Morley T.C. Sodium lighting units along trunk road A.650.—Advertised in 18 Nov. issue.

4 Dec.—Dagenham T.C. Applications invited from contractors for approved list of firms.—See 25 Nov. issue.

4 Dec.—Higham Ferrers T.C. Street lighting units along trunk road A.6.—See 11 Nov. issue.

4 Dec.—Perth. Lamps during 1955 for city's Hospital Management Board.—See 25 Nov. issue.

6 Dec.—Bury T.C. Lighting systems at the Abattoirs.—See 25 Nov. issue.

6 Dec.—Maidstone T.C. Installation in 88 houses on Shepway estate.—See 25 Nov. issue.

6 Dec.—Manchester T.C. Welding sets, test benches.—See 25 Nov. issue.

6 Dec.—Slough T.C. Group "A" street lighting columns and lamps at London Rd.—Advertised in 11 Nov. issue.

7 Dec.—Ashton-in-Makerfield U.D.C. Concrete columns, lantern lamps, wiring, etc.—See 25 Nov. issue.

7 Dec.—Clydebank T.C. Provision of street lighting along Great Western Rd (A.82). J. Craig, Inspector of Lighting, Lighting Dept., Melfort Ave.

7 Dec.—Durham. Electrical installation at Bishop Auckland fire station.—See 25 Nov. issue.

7 Dec.—Herne Bay U.D.C. Installation in 62 houses in Stanley Gdns.—See 18 Nov. issue.

7 Dec.—Pudsey T.C. Supply of hand-operated electric truck, 20 cwt and 24 V batteries. Borough Surveyor, Town Hall.

8 Dec.—Derby T.C. Electrical installation in 24 flats in Siddals Rd. Borough Architect, The Council Hse, Corporation St.

8 Dec.—Durham. Electrical work at former Johnston school in South St. G. R. Clayton, County Architect, Court Lane.

8 Dec.—Littlehampton U.D.C. Electrical installation in 16 dwellings on Wickbourne estate. Engineer and Surveyor, Council Offices. Deposit £1. 1s.

8 Dec.—Newcastle-on-Tyne T.C. Conversion from gas to electric lighting on St Anthony's estate, in Clarendon St, and at St Lawrence Sq.—See 18 Nov. issue.

8 Dec.—Twickenham T.C. Cast-iron or concrete class B columns with lanterns. —See 25 Nov. issue.

8 Dec.—West Lothian. Electrical work in 16 houses at Harthill. J. Calder, county clerk, County Bldgs, Linlithgow.

9 Dec—Clutton (Glos.), R.D.C. Electrical work in six houses at Lilton. Architects, Thomas and Morgan and Partners, 23 Gelliwasted Rd, Pontypridd. Deposit £1. 1s.

10 Dec.—Belfast. Radio receiving and reproduction equipment (about 660 points) for Musgrave Park Hospital. J. R. W. Murland, consulting engineer, 13 Wellington Place. Deposit £5. 5s.

10 Dec.—Durham. Electrical installation in hostel for aged at Stanley. G. R. Clayton, County Architect, Court Lane.

10 Dec.—Ennerdale (Cumb.) R.D.C. Wiring of 206 houses at Egremont.—See 18 Nov. issue.

10 Dec.—Heston and Isleworth T.C. Group A street lighting along Staines Rd, Hounslow.—Advertised in 25 Nov. issue.

10 Dec.—Tiverton (Dev.) R.D.C. Mercury discharge lighting along Exeter-Leeds trunk road A.38.—Advertised in 11 Nov. issue.

10 Dec.—Wicklow. Electrical installation at Shelton Abbey for Commissioners of Public Works. J. Tyrrell, secretary, Office of Public Works, Dublin. Deposit £1.

11 Dec.—Dewsbury T.C. Electrical equipment required for establishments maintained by Welfare Services Committee. Chief Officer, Municipal Bldgs, Halifax Rd.

11 Dec.—East Anglia. Applications invited from firms wishing to be included in approved list of contractors for electrical and other works. E. Anglian Hospital Board's Architect, 33 Parkside, Cambridge.—Advertised in this issue.

13 Dec.—Birmingham. Switchgear, transformers, MV fuses switchboard, motor control gear.—See 25 Nov. issue.

13 Dec.—Dublin T.C. Electrical installation in new technical school for boys in Emmet Rd, Inchicore. M. M. Gleeson, chief executive officer, Education Offices, Town Hall, Merrion Rd, Ballsbridge, Dublin. Deposit £5. 5s.

13 Dec.—Manchester T.C. Overhead electric-driven cranes, etc., wiring, lighting, heating installation, for Davyhulme sewage works.—See 11 Nov. issue.

13 Dec.—Worksop T.C. Removal of 11 street lighting standards; supply erection etc., of 17 140 W sodium lighting units on steel columns. Borough Engineer, Park Hse. Deposit £3. 3s.

13 Dec.—Wortley R.D.C. Class B street lamps with concrete columns at Stanniington.—See 25 Nov. issue.

14 Dec.—Bilston T.C. Supply and erection of ten 250 W mercury discharge lamps on concrete columns in group A, and about 74 lamps in group B. Borough Engineer, 20 Wellington Rd. Deposit £2. 2s.

14 Dec.—Stockport T.C. Class B mercury vapour street lighting units, etc. —See 18 Nov. issue.

16 Dec.—Belfast T.C. Metering equipment.—Advertised in 25 Nov. issue.

17 Dec.—Antrim. Supply of electrical equipment for Moyle Hospital, Larne. Secretary, E. Antrim Hospital Management Committee, Moyle Hospital.

18 Dec.—Mossley T.C. Provision of street lighting included in services required on Micklehurst housing site. Borough Surveyor, Town Hall. Deposit £2. 2s.

18 Dec.—Wembley T.C. Lamps in year from 1 April.—See 25 Nov. issue.

21 Dec.—Antrim. Electrical installation at Moyle Hospital, Larne. Secretary of E. Antrim Management Committee at the Hospital. Deposit £3. 3s.

21 Dec.—Dublin T.C. Lighting, power, etc., installations in former Fever Hospital premises in Cork St. N. Mathews, consulting engineer, 42 Fitzwilliam Place. Deposit £10.

21 Dec.—Ilford T.C. Electrical installations in 119 houses and removal of existing systems. Borough Engineers, Town Hall. Deposit £2. 2s.—Advertised in this issue.

21 Dec.—Poole T.C. Installation of electrical plant for Broadstone sewage works.—See 18 Nov. issue.

23 Dec.—Dorchester T.C. Equipment for mercury discharge lighting units along trunk road A.35.—Advertised in 18 Nov. issue.

28 Dec.—Morpeth T.C. Supply and erection of 84 group A 140 W sodium vapour lighting units on steel columns

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources including an index of trade information with over 100,000 entries

A Selection from the 117 queries answered this week

Shop window book page turning devices, makers of? S.G.R.—Kirdon Electric Ltd., Factory Yard, Hanwell Broadway, W.7.

"Nestle" hairdryers, makers of? W.C.L. C. Nestle and Co., Ltd., York St, Sidmouth, Devon.

Woods and Co., makers of conduit vices, address for? S.B.—70/72 Lancefield St, W.10.

3 in. power coaxial cable with a helical membrane, makers of? V.P.—Telegraph Construction and Maintenance Co., Ltd., Telcon Works, S.E.10.

"ERG" irons, makers of? M.N.W.—Erg Industrial Corpn, Ltd., 10 Portman Sq, W.1.

Graph paper as shown in the article by H. E. Green "Special Graphs for Engineers," which appeared on page 617 of the 1 Oct., 1953, issue, suppliers of? M.R.—Wightman Mountain Ltd., Artillery Hse, Artillery Row, S.W.1.

Floorboard cutting saw as noted by "Megohm" in the 9 Sept., 1954, issue, makers of? D.B.L.—Brixey Ltd., Fancy Rd, Newtown, Parkstone, Dorset.

ANSWER WANTED

"Jeka" floor-mounted radial-fin car heater, makers of? H.H.

and wall brackets with control gear, etc. along trunk road A.1. Borough Surveyor, 36 Bridge St. Deposit £2. 2s.

30 Dec.—Co. Kerry. Supply and installation of electrically driven boiler feed pumps, hot water accelerators and sod breaker or macerator at Mental Hospital, Killarney. E. R. Ryan, consulting engineer, 1 Montpelier Terr., Galway. Deposit £3. 3s.

31 Dec.—Belfast T.C. List of stores required has been published and tenders are invited. Forms Nos. 29 and 30 from Elect. Dept., East Bridge St. at 10s. each. Tenders (No. W.58) also invited for condenser tubes, tube plate ferrules and packing, and (No. W.60) for coal conveying plant at Power Station West. Documents from Elect. Dept. Deposit £2. 2s. —Both advertised in this issue.

31 Dec.—Grimsby T.C. Electrical installations in special school for educationally sub-normal pupils in Carnforth Crescent. J. V. Oldfield, Borough Engineer and Architect, Municipal Offices, Town Hall Sq. Deposit £5.

31 Dec.—Manchester T.C. Electrical installation at Plant Hill county secondary school for boys. City Architect, P.O. Box 488, Town Hall.—Advertised in this issue.

31 Dec.—Wandsworth B.C. Lamps in year from 1 Apr., and electrical works for three years.—See 25 Nov. issue.

3 Jan.—Richmond (Yorks) R.D.C. Electrically operated ejector plant and pumping plant required for Gilling sewerage, and also pumping plant for Aldborough sewerage. Consulting Engineer, Arnold Brooksbank, 14 The Exchange, Bradford. Deposit £3. 3s.

6 Jan.—Belfast T.C. Extensions to low pressure piping installations at Power Station West. — Advertised in 25 Nov. issue.

7 Jan.—Sheffield T.C. Installations at colleges of technology and commerce in Pond St.—See 25 Nov. issue.

8 Jan.—Ruislip-Northwood U.D.C. Supply of electric lamps in year from 1 Apr. Engineer and Surveyor, Council Offices, Northwood, Middx.

12 Jan. Dublin. Supply and erection of three overhead travelling electric gantry cranes of 25 cwt capacity. Engineer's Office, Dublin Port and Docks Board, East Wall Rd. Deposit £10.

21 Jan.—Dundalk U.D.C. Supply and erection of two electrically-operated pumping units with accessories for water supply augmentation scheme. P. H. McCarthy and Son, 26 Lr. Leeson St, Dublin, consulting engineers. Deposit £5. 5s.

24 Jan.—Newcastle-on-Tyne. Supply and erection of three 3-ton and alternatively three 5-ton electric cargo-grabbing cranes at Albert Edward Dock. J. K. McKendrick, secretary, Tyne Improvement Commission, Bewick St. Deposit £5. 5s.

No date stated.—Aberavon. Power and lighting installations for Wales Gas Board.—See 25 Nov. issue.

No date stated—N. of Scotland H.E. Board. Supply of outdoor 33 kV switchgear and ancillary equipment for Cassley substation. Kennedy and Donkin, 12 Caxton St, London S.W.1. Deposit £2. 2s. —Advertised in this issue.

. . . and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon House, Theobalds Rd, W.C.1, quoting reference.*

21 Dec.—Kuwait. Dept. of Electricity, Govt. of Kuwait, requires supply of junction boxes, flexible metallic conduit and steel conduit. B.o.T. (Ref.: ESB 27044/54).*

21 Dec.—Uruguay. Equipment for protection, measure and automatic regulation of generating groups; voltmeters, terminal boxes, potential transformers, switch fuses, current transformers, alarm bells, disconnecting switches, etc. Usinas Electricas y los Telefonos del Estado. B.o.T. (Ref.: ESB 26409/54).*

22 Dec.—Australia. Supply, etc., of 85 distribution transformers between 10 kVA and 500 kVA, 3-phase, for Capricornia and Townsville Boards of State Electricity Commission of Queensland, Scottish Union Hse, Eagle St, Brisbane. B.o.T. (Ref.: ESB 27023/54).*

23 Dec.—South Africa. Supply of 20 kW diesel-electric generating sets for State Sawmill, Tweefontein. Union Tender and Supplies Board, Corner Bosman and Silverman St, P.a. Box 371, Pretoria. Tender No. S.O. 7900. B.o.T. (Ref.: ESB 27179/54)*

4 Jan.—U.S.A. Manufacture, supply, etc., of four main control steel switchboards with instruments, meters, recorders, relays, control, test blocks, annunciators, terminal blocks, etc., with spares. Tender No. CIVENG-45-108-55-24. Seattle District, U.S. Army Corps of Engineers. B.o.T. (Ref.: ESB 26736/54).*

26 Jan.—New Zealand. Tenders (P. and T. 150/7453) invited for total of 21,000 switchboard chords. Director-General (Stores Div.), G.P.O., Wellington.

28 Jan.—New Zealand. Supply of 3,700 lamps, 50 V, 40 W, B.C. Pearl, rough service (traction or reinforced filament lamps). Tender No. P. and T. 150/7527, Director-General (Stores Div.), G.P.O., Wellington.

31 Jan.—India. Supply of one 4,000 kW turbo-alternator and one 45,000 lb/hr boiler for Bhavnager power house extension. Specifications from B.P. Mehta, manager, Bhavnager Electricity Co., Ltd., Power Hse, Bhavnager, at Rs. 15.

Contracts Placed

Burnley T.C. Installation of electrical pumps, switchgear, etc., in proposed Booster Hse, Gwynne's Pumps Ltd., £2,228.

Glasgow T.C. Supply of 600 steel lighting standards with brackets, Stewarts and Lloyds Ltd., £15,375.

Haddington T.C. Mercury fluorescent discharge street lighting in various streets involving some 240 points, Metropolitan-Vickers Electrical Co. Ltd., £6,110.

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Tuesday, 30 November

	£ per ton	Weekly change £	Price last year £
COPPER, standard class A (settlement)	265½	−8½	231½
„ (3 months)	257	−9	222½
LEAD, refined pig, min. 99·97% purity (cash)	103½	−4	90½
„ (3 months)	102½	−2	88½
TIN, refined, min. 99·75% purity (settlement)	717½	−7½	627½
„ (3 months)	715	−3	617½
ALUMINIUM, ingots 99·99·5%	156	—	150
ZINC, virgin, min. 98% purity (cash)	80⅞	+⅛	73⅛
„ (3 months)	80⅞	+⅛	73⅛
RUBBER No. 1, RSS. spot (per lb.)	25d.	−⅛d.	17⅞d.
„ c.i.f. basis, ports. Feb. (per lb.)	23⅞d.	−¼d.	17⅞d.
ARMOURING:			
Galv. Steel Wire (0·104 in.)	52½	—	51½
Mild Steel Tape (0·014 in.)	40½	—	40

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons, Ltd., 116 Chancery Lane, W.C.2.

Autolec Boilers Ltd. Electrical, mechanical and general engineers; makers and manufacturers of and dealers in boilers, furnaces, etc. Nom. cap.: £1,000. Dirs.: not named. Subs.: F. Thompson and G. S. Flint, 11 Old Jewry, E.C.2.

Bracknell Refrigeration Services Ltd., 6 Brockenhurst Rd, South Ascot, Berks. Nom. cap.: £750. Dirs.: B. P. Irish and R. H. Gaywood.

Space Heating Ltd., 121, London Wall, E.C.2. Electrical and mechanical engineers, etc. Nom. cap.: £100. Dirs.: to be appointed by subs. Subs.: S. Van der Stuis and S. M. Hart, 11 Hertford St, W.1.

Ayre Productions Ltd. Manufacturers of electronic instruments, equipment and supplies of all kinds, etc. Nom. cap.: £5,000. Dirs.: to be appointed by subs. Subs.: P. J. Saunders and Elsie Archer, 5 Queen Anne St, W.1.

Geoff. A. Smith Ltd. 1a High Rd, Balby, Doncaster. To take over business of automobile electrical engineer, instrument maker and re-winder, garage proprietor, radio, television and domestic appliance dealer and service engineer carried on at Coniston Rd, Doncaster and Balby, Doncaster, by Geoffrey A. Smith. Nom. cap.: £300. Dirs.: G. A. Smith, Mary Smith and T. Emery.

R. W. Bannister and Son (Oxford) Ltd. 81 Magdalen Rd, Oxford. Manufacturers of and dealers in refrigeration and cold storage plant and machinery, etc. Nom. cap.: £4,000. Dirs.: R. W. Bannister, senr., and R. W. Bannister, junr.

Wyvern Engineering Co., Ltd. Electricians, mechanical engineers, etc. Nom. cap: £500. Dirs.: not named. Subs.: R. Lodge, 123 Billet Lane, Hornchurch, Essex, and E. R. Davell, 26 Stafford Rd, E.7.

L. J. Transmission Co., Ltd. Mechanical, electrical, aeronautical and general engineers, etc. Nom. cap.: £1,000. Permanent dirs.: C. E. Steiner and Phyllis E. Cassidy, 35 Rosslyn Hill, N.W.3.

Lawrence Perrins and Sons Ltd. 176 Oldham Rd, Springhead, nr. Oldham. Manufacturers of and dealers in dynamos, motors, armatures, etc. Nom. cap.: £2,000. Dirs.: L. Perrins and Mrs M. Perrins.

H. J. Greatorex Ltd., 203 Regent St, W.1. Heating and domestic engineers, mechanical and electrical engineers, etc. Nom. cap.: £1,000. Dirs.: to be appointed by subs. Subs.: Mrs L. M. Greatorex and H. J. Greatorex, 3 Beulah Close, Edgware, Middx.

BUSINESS PROSPECTS

Home

Bath T.C. Erection of 11-storey block of 44 flats in Snow Hill redevelopment scheme. W. E. Underwood and Son, quantity surveyors, 21 Gary St.

Billingham-on-Tees. I.C.I. Ltd. to construct apprentices' training school in Beksis Lane.

Chester T.C. It is proposed that renewal of lighting in Hoole and Newton school, All Saints' school and Westminster school be included in 1955-56 estimates.

Clitheroe T.C. Approval given for erection of 68 houses on Littlemoor site.

Coventry. Factory and offices in Broad Lane proposed by Veasey and Sharples Ltd., 416 Stoney Stanton Rd.

Cuckfield (Sus.) U.D.C. Scheme approved for £15,000 extension to council's offices at Oakland, Haywards Heath.

Deptford. It is proposed to build five-storey block of flats, and other buildings in Giffin St area at cost of about £92,490.

Droylesden U.D.C. Erection of 60 flats on Gloucester Rd estate. F. Bradley, Penny Bank Chambers, 4 Wood St, Bolton.

Durham. Scheme approved for new technical college at Bishop Auckland, first stage of which will cost about £93,000.

Easington. It is proposed to rebuild Empire Cinema. Owners are W. and B. Theatres Ltd., and architects are C. L. Heslop, 7 Upper Church St, West Hartlepool.

East Riding. Erection of county secondary school at Hornsea. County Architect, County Hall, Beverley.

Evesham T.C. Erection of 36 houses and 8 bungalows at Fairfield. Council's Architects, Panberton and Bateman, 21 Vine St.

Goole T.C. Development of Western Rd estate to be continued with erection of 59 houses and four bungalows.

Grantham T.C. Fifty houses to be built on site between Belton and Harrowby Lanes.

Hale U.D.C. Erection of 72 houses on Delahays Rd estate. Engineer and Surveyor, Council Offices, Ashley Rd.

Hertfordshire. Seven schools included in 1955-56 programme. These include £101,640 secondary modern at Waltham Cross; £168,600 girls' grammar at Stevenage; £168,600 mixed grammar at Welwyn Garden City; £160,047 Bushey Coldharbour secondary modern; and £10,000 Rickmansworth secondary modern extensions.

Hinckley U.D.C. Erection of 32 flats on Mill Lane estate, Earl Shilton. Council's Architect, Council Offices.

Isle of Wight. Approval received for erection of Ventnor secondary modern school at estimated cost of £137,208.

Litherland U.D.C. Erection of 74 houses on Ford estate Surveyor, Town Hall.

Nottingham. Raleigh Industries Ltd. to build two more factories. Plans in hand for immediate building of factory in Triumph Rd, and major works will be built as soon as plans and formalities are complete.

Preston. Erection of secondary modern school in Longridge Rd, for R.C. Authorities. W. C. Mangan, C.A., 2 Ribblesdale Place, Preston.

Rochester T.C. Approval received for scheme to erect 150 houses on Temple estate at estimated cost of £202,160.

Surbiton. Kingston Instrument Co., Ltd., have submitted plans for factory. Architects are Anderson and Eglinton, King's Stone Hse, High St, Kingston.

Thornaby-on-Tees T.C. Consideration being given to scheme to allow council house tenants facilities to use extra electrical appliances.

Warmley (Glos.) R.D.C. Erection of 44 houses on Parkwall estate. M. Fudge, clerk of council, Council Offices, Warmley Hse.

Widnes T.C. Construction of (*a*) 3-storey block of 6 shops and 6 maisonnettes and two blocks of (24) flats on Crow Wood estate; and (*b*) 3-storey block of 19 shops and 14 maisonnettes on Ditton neighbourhood unit. H. Nevile Player, Borough Architect, Brendan Hse, Widnes Rd.

Overseas

Colombia. Indurayon Consolidada, S.A., Via 40 No. 79-190, Barranquille, are to expand the present factory by installing steam and power plant. They would like to contact U.K. makers of boilers and turbo-generators. Export Services Branch of B.o.T. have further details (Ref.: ESB 26845/54).*

India. Pearey Lal and Sons (East Punjab) Ltd., Kashmere Gate, Delhi, would like to represent U.K. manufacturers of railway stores and electrical equipment, including train lighting, switchgear and batteries, l.t. insulators, machine tools.

U.S.A. Quotations from U.K. manufacturers for various types of electric motors for driving tape recorders sought by Mr William L. Dunn, president of Magnecord Inc., 1101 S. Kilbourn Ave, Chicago.

TRADE NOTES

Change of Name. The title of Associated Technical Manufacturers Ltd. has been changed to Permanoid Ltd.

New Office and Showroom. Alumilite and Alzak Ltd., have opened a Birmingham office and showroom at Holborn Chambers, 321 Broad St, Birmingham, 1. Telephone Birmingham Midland 0132. The sales office is under the control of Mr R. O. V. Cross.

Manchester Depot. Ecko-Ensign Electric Ltd. have moved their Northern area sales office, showroom and storage depot from Preston to Blackett St, Manchester 12. Telephone Ardwick 4661. Mr F. A. Thiel is the area sales manager.

Changes of Address. The address of the Manchester area office of Elliott Bros. (London) Ltd., Bristol's Instrument Co., Ltd., and the Fisher Governor Co., Ltd., is now: 32 Deansgate, Manchester 3. Telephone, Blackfriars 7752 and Deansgate 6331.

The Flame Radiation Research British Committee is now at 6 DeVere Gdns, London W.3. Telephone Western 0761.

Distribution Depot. H. Fisher (Oldham) Ltd., have appointed E. A. Wood Ltd., of 100 Aston Rd, Birmingham 6, and Eltek Hse, 61 Belgrave Rd, Leicester, as their main distributors for the counties of: Herefordshire, Gloucestershire, Warwickshire Shropshire, Worcestershire, Leicestershire and Rutland.

N.Z. Duty on Motors. Under a recent tariff amendment order, electric motors of between 1 and 6 b.h.p. are free of duty from Britain, but carry a most-favoured nation rate of duty of 20%, and a general duty of 30%, *ad valorem*, when imported into New Zealand.

Gazette Announcements

COMPANIES ACTS

Domestic Metalwares Ltd. Resolution for voluntary winding-up passed at meeting on 12 Nov. when H. C. Castle, 121 Colmore Rd, Birmingham,

Gamma Electronics Ltd. Liquidator, J. M. Clarke, Inveresk Hse, Strand, London, W.C.2, released as from 18 Nov.

Allied Insulators Ltd. C. H. Barclay of 5 Giltspur St, London, E.C.1, the company's liquidator released as from 6 Oct.

Voluntary Liquidation

Aircraft and Garage Equipment Ltd. As result of meetings of creditors, R. P. Booth, C.A., of Parkin S. Booth and Co., 5 Rumford Place, Liverpool, has been appointed liquidator. According to statement of affairs liabilities amount to £4,498, of which £352 is due to trade and expense creditors; £1,774 to Bank, and £2,368 17s. 6d. in respect of loans. Assets estimated to produce £506 and after allowing £481 for preferential claims there are net assets of £25, or deficiency as regards creditors of £4,472. Issued share capital is shown at £7,200 and, so far as shareholders are concerned, total deficiency is £11,672.

Cox's Radio and Electrical Co., Ltd. Liabilities of £7,390, of which £4,574 was due to trade creditors; £1,450 in respect of loans; and £1,364 to Bank, were shown in statement of affairs submitted to statutory meeting of creditors. Assets of book value of £5,535 were estimated to realise £2,898 and after deducting £5 for preferential claims, there were net assets of £2,893, or deficiency as regards creditors of £4,497. Issued share capital was shown at £100 and, so far as shareholders were concerned, there was total deficiency of £4,597. Creditors passed a resolution confirming voluntary liquidation with E. F. Beardsmore, acc., of National Provincial Bank Chambers, Five Ways, Birmingham, as liquidator, with a committee of inspection.

BANKRUPTCY ACTS

Release of Trustee

Banbury. Cecil R. Boyden, electrical engineer trading at 19a Castle St West, Banbury. Trustee was W. J. W. Hill, Official Receiver, 58-61 York Terr., Regent's Pk, London, N.W.1.

Application for Discharge

Stourbridge. Frederick R. A. Lock and Victor C. Lock, trading as Locke Bros, electrical engineers, in Union St, Stourbridge. Hearing will be at The Court Hse, Hagley St, Stourbridge, on 13 Jan. at 10.30 a.m.

First Meeting

Warwick. Derek G. H. Hammerton and Arthur J. Cummings trading as A. C. D. Electric Co. at 28 West St, Warwick. First meeting is today (Thurs.) at Official Receiver's Office, Somerset Hse, Temple St, Birmingham, at 11.45 a.m. Public examination will be at Shire Hall, Warwick, on 28 Jan. at 2.15 p.m.

Intended Dividends

Croydon. Henry C. Francis, electrical engineer trading at 5a Brighton Rd, Redhill. Last day for receiving proofs, 7 Dec. Trustee is C. T. Newman, Official Receiver, 58-61 York Terr, Regent's Park, N.W.1.

MEETINGS TO NOTE

THURSDAY, 2 DEC.

INCORP. PLANT ENGRS. (Peterboro'). "Railway Electrification." Gas Offices, Church St, 7.30 p.m.

I.E.E. (London). "Electrification of Manchester-Sheffield-Wath Lines of B.R." J. A. Broughall and K. J. Cook. Savoy Place, W.C.2, 5.30 p.m.

I.E.E. (N.E. Radio and Measurements). "Radio Stars." R. Hanbury Brown. King's College, Newcastle, 7 p.m.

I.E.E. (N. Midland). "Aluminium-Sheathed Cables," P. M. Hollingsworth. Elect. Offices, Ferensway, Hull, 7.15 p.m.

CHELMSFORD ENGRG. SOC. "Trends in Heat Pump Development," J. A. Sumner. Social Hall at Hoffmann's, 7.30 p.m.

A.S.E.E. (S. London). "Electronics in Industry," T. S. Worthington. Cafe Royal, North End, Croydon, 8 p.m.

BRIT. INSTN. OF RADIO ENGRS. (Merseyside). "Electronics in Materials Handling," L. Landon Goodman. College of Technology, Byrom St, Liverpool, 7 p.m.

BRIT. INSTN. OF RADIO ENGRS. (Scottish). "Applications of Electronics to Photography, D. M. Neale. 39 Elmbank Cresc., Glasgow, 7 p.m.

I.E.S. (Cardiff). "Lighting for Enjoyment," T. O. Freeth. Elect. Offices, The Hayes, 5.45 p.m.

I.E.S. (Glasgow). "Dock and Railway Lighting," W. T. F. Souter. 39 Elmbank Cresc., 7.30 p.m.

I.E.S. (Nottingham). "New Approach to Lighting Design," W. Robinson. Elect. Offices, Smithy Row, 6 p.m.

FRIDAY, 3 DEC.

I.E.E. (N.E. Students). "Review of Development of High-Speed Oscillography," H. Hollaway. King's College, Newcastle, 6.30 p.m.

IPSWICH ELECTRICAL ASSOC. Annual dinner at Great White Horse Hotel, Ipswich.

A.S.E.E. (Liverpool). "Joints for Power Cables," B. A. Maxted. Liverpool Engrg. Soc., 9 The Temple, 24 Dale St, 7.30 p.m.

SATURDAY, 4 DEC.

INCORP. PLANT ENGRS. (Glasgow). Annual dinner and dance at Rhul Restaurant, Sauchiehall St.

MONDAY, 6 DEC.

I.E.E. (London). Discussion on "Applications and Limitations of Electronic and other Computors," L. G. Brazier. Savoy Place, W.C.2, 5.30 p.m.

I.E.E. (Mersey and N. Wales). Faraday lecture on "Courier to Carrier in Communications," T. B. D. Terroni. Philharmonic Hall, Liverpool, 6.45 p.m.

I.E.E. (N.E. Radio and Measurements). "Investigation of Characteristics of Cylindrical Surface Waves," Prof. H. E. M. Barlow and A. E. Karbowiak; "Surface Waves," Prof. H. E. M. Barlow and A. L. Cullen. King's College, Newcastle, 6.15 p.m.

I.E.E. (S. Midland). "Technical Arrangements for Sound and TV Broadcasts of Coronation," W. S. Proctor, M. J. L. Pulling and F. Williams. James Watt Memorial Inst., Great Charles St, Birmingham, 6 p.m.

I.E.E. (Maidstone). "Safety in Use of Portable and Transportable Electrical Equipment in Industry," J. W. Bunting. Wig and Gown Hotel, 7.30 p.m.

NORTH EAST ELECTRICAL CLUB. "Ventilation," J. C. Byles. Liberal Club, 98 Pilgrim St, Newcastle, 6 p.m.

SMITHFIELD SHOW AND AGRIC. MACHINERY EXHIBN. at Earls Court, continuing until 10 Dec.

I.E.S. (London). "Maintenance of Lighting Installations," J. Mortimore Hawkins, W. Robinson and J. W. Strange, 2 Savoy Hill, W.C.2, 6 p.m.

A.S.E.E. (Leeds). "Fluorescent Application," R. Pye. Great Northern Hotel, 7.30 p.m.

A.S.E.E. (N.E. London). "Transmission and Distribution of Electricity at Royal Docks," F. W. Sheppard. Angel Hotel, Ilford, 8 p.m.

ROCHDALE ELECT. TRADES TECH. SOC. "Space Heating by Electricity," W. S. Gee. Electric Hse, Smith St, 7.45 p.m.

E.P.E.A. (London).—"Fuel Resources and Atomic Energy." S. G. Bauer. Caxton Hall, S.W.1, 7 p.m.

TUESDAY, 7 DEC.

INCORP. PLANT ENGRS. (Edinburgh). "Lighting in Industry," C. J. King, 25 Charlotte Sq, 7 p.m.

INCORP. PLANT ENGRS. (London). "Heat Treatment of Steel." C. Haywood, Royal Soc. of Arts, John Adam St, W.C.2, 7 p.m.

ROYAL STATISTICAL SOC. (Industrial Applications Group, Glasgow). "Use of Graphical Statistics in Steelmaking," D. Hadfield. 39 Elmbank Cresc, 7.30 p.m.

I.E.E. (E. Midland). "High Altitude Testing of Aircraft Electrical Machines," R. F. Sims. Elect. Showrooms, Derby, 6.30 p.m.

I.E.E. (Cambridge Radio). "Transistor Circuits," E. H. Cooke-Yarborough. Cambridgeshire Tech. College, 6 p.m.

I.E.E. (N. Midland). "Design Features of Semi-Outdoor Power Station at Ince," F. H. S. Brown. Elect. Offices, 1 Whitehall Rd, Leeds, 6.30 p.m.

I.E.E. (N. Western). "Electrification of Manchester-Sheffield-Wath Lines of B.R.," J. A. Broughall and K. J. Cook. Engrs. Club, Albert Sq, Manchester, 6.15 p.m.

I.E.E. (S.E. Scotland). "Technical Arrangements for Sound and TV Broadcasts of Coronation," W. S. Proctor, M. J. L. Pulling and F. Williams. Carlton Hotel, Edinburgh, 7 p.m.

I.E.E. (London Students). "Fluorescent Lighting Control Circuits," G. V. McNeill. Savoy Place, W.C.2, 6.30 p.m.

I.E.S. (Stoke-on-Trent). "Marine Lighting," T. Catten. Elect. Offices, 31 Kingsway, 6 p.m.

A.S.E.E. (S.E. London). "Electro-Plating," Congregational Church Hall, Court Rd, Eltham, 8 p.m.

A.S.E.E. (S. Wales). "Theatrical Lighting," G. W. Timms. Angel Hotel, Westgate St, Cardiff, 7.30 p.m.

A.S.E.E. (W. London). "Heat Pump for Domestic Purposes," J. A. Sumner. Magnet Hse, Kingsway, W.C.2, 6.30 p.m.

WEDNESDAY, 8 DEC.

INCORP. PLANT ENGRS. (E. Midlands). "History and Development of Displacement Pumps," W. R. Groves. Adult Education Centre, Shakespear St, Nottingham, 7 p.m.

I.E.E. (London Educ.). Discussion on "Kinetic Theory of Gases for Engineering Students," M. R. Gavin. Savoy Place, W.C.2, 6 p.m. (Joint meeting with INSTN. OF MECHANICAL ENGRS.).

I.E.E. (N. Scotland). "Determination of Static and Dynamic Properties of Resilient Materials," R. S. Jackson, A. J. King and C. R. Maguire. Caledonian Hotel, Aberdeen, 7.30 p.m.

I.E.E. (Southern). "Safety in Use of Portable and Transportable Electrical Equipment in Industry," J. W. Bunting, Technical College, Brighton, 6.30 p.m.

I.E.E. (Hatfield) "Magnetic Amplifiers," J. F. Coales. Technical College, 7 p.m.

ENGINEERS' GUILD. Annual meeting at 16 Queen Anne's Gate, London, S.W.1, 5.45 p.m.

NAT. POULTRY SHOW at Olympia, London, until 10 Dec.

BRIT. INSTN. OF RADIO ENGRS. (N. Eastern). "Logic, Algebra and Relays," Prof. Emrys Williams, Neville Hall, Westgate Rd, Newcastle, 6 p.m.

BRIT. INSTN. OF RADIO ENGRS. (W. Midlands). "Industrial Applications of Electronic Control," J. A. Sargrove. Tech. School, Wulfruna St, Wolverhampton, 7.15 p.m.

I.E.S. (Newcastle). "Fluorescent Stage Lighting and other Applications of Fluorescent Lamp Dimming," H. H. Ballin. Newe Hse Lecture Theatre, Pilgrim St, 6.15 p.m.

I.E.S. (N. Lancs). "Studies in Interior Lighting," J. M. Waldram. Elect. Offices, 19 Friargate, Preston, 7.15 p.m.

A.S.E.E. (York). "Outdoor Lighting," J. Howell. Picture Hse Cafe, Coney St, 7.15 p.m.

A.S.E.E. (Birmingham). Film Show at Chamber of Commerce, New St, 7 p.m.

A.S.E.E. (Bradford). "Further Applications of Electronic Control," G. Craven. Midland Hotel, 7.30 p.m.

THURSDAY, 9 DEC.

INCORP. PLANT ENGRS. (North-East). Film Show. Roadway Hse, Oxford St, Newcastle, 7 p.m.

I.E.E. (London Utilisation). "Brushless Variable-Speed Induction Motor," Prof. F. C. William and E. R. Laithwaite. Savoy Place, W.C.2, 5.30 p.m.

I.E.E. (N. Scotland). "Determination of Static and Dynamic Properties of Resilient Materials," R. S. Jackson, A. J. King and C. R. Maguire. University College, Dundee, 7 p.m.

I.E.E. (Swansea). "Royal Festival Hall, Electrical Installation," J. G. Hunter. Elect. Offices, The Kingsway, 6 p.m.

I.E.E. (Bristol Students). Students' lecture on "Attitudes of the Mind," A. R. Cooper. Elect. Offices, Colston Ave, Bristol.

DERBY ELECTRICAL SOC. "Radio Isotopes in Industry," J. L. Putman. Elect. Showrooms, Irongate, 7 p.m.

I.E.S. (Manchester). "Studies in Interior Lighting," J. M. Waldram. Elect. Offices, Town Hall, 6 p.m.

FRIDAY, 10 DEC.

INCORP. PLANT ENGRS. (Yorks). Film Show. Great Northern Hotel, Leeds, 7.30 p.m.

I.E.E. (Rugby). Faraday lecture on "Courier to Carrier in Communications," T. B. D. Terroni. Temple Speech Room, 7 p.m.

E.P.E.A. (Southern Meter Engrs.). "Ripply Control, Tool for the Power Engineer," L. H. Yardley. Caxton Hall, Westminster, S.W.1, 6.30 p.m.

LEICESTER ELECTRICAL SOC. Christmas party at Corn Exchange.

A.S.E.E. (N.W. London). "Manufacture of a.c. Induction Motors," R. T. Sutton. Century Hotel, Forty Ave, Wembley Park, 8.15 p.m.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Polyformer. 733,143. Class 9. Indicating and measuring apparatus and instruments, etc. B.P.L. (Instruments) Ltd., Houseboat Works, Watling St, Radlett, Herts.

Tarpen. 733,883. Class 7. Hedge trimming and grass cutting machines, etc. Tarpen Eng. Co., Ltd., Ixworth Hse, Ixworth Place, S.W.3.

Emitape. 733,694. Class 9. Apparatus employing tape for recording, etc. Electric and Musical Industries Ltd., Blyth Rd, Hayes, Middx.

Airtex. 733,979. Class 9. Cables and insulated wires. J. Day and Co. (Derby Works) Ltd., Harrow Manor Way, S.E.2.

Dynamaster. 729,163. Class 9. Apparatus and instruments for use in controlling, indicating, recording and measuring electrical values, pressure, temperature, etc. Bristol's Instrument Co., Ltd., Lynch Lane, Weymouth, Dorset.

Trumod. 733,884. Class 9. Instructional, teaching, scientific and electrical apparatus and instruments. Teebee Mfg. Co., Ltd., 205 Hook Rd, Surbiton, Surrey.

Overhead Service Accessories

60 AMP

Two additional Service Fuses for outdoor use are now available, one for maximum continuous working current up to 60 amp and the other up to 200 amp, both being suitable for Cartridge Fuse-links. The design is based on that of the well-known HENLEY 100 amp Outdoor Service Fuses but arranged to accommodate Cartridge Fuse-links.

HENLEY Outdoor Service Fuses

200 AMP

CARTRIDGE TYPE

Suitable for mounting on walls, on poles or with shackle type insulators.

Please ask for Folder 47/A.

W. T. HENLEY'S TELEGRAPH WORKS CO., LTD. 51-53 HATTON GARDEN, LONDON, E.C.1

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B.S. 546
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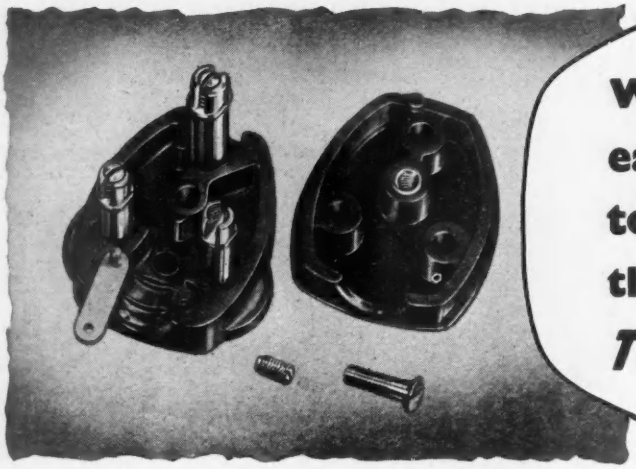
Wiring Regulations

The TEMCO 3-pin Top Entry Switch Socket is now fitted with a flared top to prevent overhang and so complies fully with B.S.546 and I.E.E. Wiring Regulation 1312 (C) 12th Edition. It can be used with confidence when low cost is the primary consideration.



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CLASSIFIED ADVERTISEMENTS

Advertisements should be sent to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London, W.C.2, before 10 a.m. on TUESDAY of the week of issue. Official Displayed Advertisements are charged at 32s. 6d. per inch, and all other classified advertisements at 2s. 6d. per line. Situations Wanted four insertions at twice the single insertion rate. Fee for Box Number and postage on replies 2s.

TENDERS INVITED

CITY OF MANCHESTER

THE Education Committee invite tenders for the Electrical Installation required at Plant Hill County Secondary School for Boys, Hr. Blackley, Manchester. Specification and tender form may be obtained from the City Architect, P.O. Box No. 488, Town Hall. Tenders, sealed in endorsed envelopes, must be delivered before 10 a.m. on 31 Dec., 1954.

PHILIP B. DINGLE,
Town Clerk.

29 Nov., 1954. (P 96)

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

SHIN—CAITHNESS TRANSMISSION

TENDERS are invited for the provision of outdoor 33 kV Switchgear and Ancillary Equipment for Cassley Substation. Copies of the Tender Document may be obtained on application, with a cheque for £2. 2s. (returnable), to the Engineers, Messrs Kennedy and Donkin, 12 Caxton St, London, S.W.1.

The Board do not bind themselves to accept the lowest or any Tender.

W. D. D. FENTON,
Secretary.

16 Rothesay Terr,
Edinburgh 3. (P 83)

EAST ANGLIAN REGIONAL HOSPITAL BOARD

CONTRACTS FOR ENGINEERING SERVICES

THE Board invite applications from competent engineering firms for inclusion in their approved list of contractors capable of executing new works and/or additions to existing hospital engineering services in the Region. The area administered by the Board includes Cambridgeshire, the Isle of Ely, Norfolk, Huntingdonshire, East and West Suffolk, the Soke of Peterborough and parts of South Lincoln and North Essex.

The classes of work and cost ranges into which the list is sub-divided are set out below:

Classes of work:

(*a*) Mechanical Engineering Services (including heating apparatus, hot and cold water, steam, kitchen and laundry installations, boiler installations, sterilising apparatus).
(*b*) Electrical installations and all auxiliary services.
(*c*) Sewage disposal plants.
(*d*) Lift installations.
(*e*) Cold Storage and refrigeration.
(*f*) Well sinking and boring.

Cost range (for each class of work):

(i) Up to—£500.
(ii) £500—£1,500.
(iii) £1,500—£5,000.
(iv) £5,000—£10,000.
(v) Over £10,000.

Firms desirous of being considered for inclusion in the list may obtain further details, on forms of application, by writing direct to the Board's Architect, 33 Parkside, Cambridge, not later than 11 Dec., 1954.

K. V. F. MORTON,
Secretary.

117 Chesterton Rd,
Cambridge. (P 68)

BOROUGH OF ILFORD

ELECTRICAL INSTALLATIONS—KINGSLEY ESTATE

THE Corporation invite tenders from electrical contractors for the removal of existing electrical installations in 119 occupied houses and the provision of new installations as specified. Copies of the specification, drawings and conditions of contract may be obtained from the Borough Engineer, Town Hall, Ilford, on payment of a deposit of two guineas which is returnable upon receipt of a bona fide tender not subsequently withdrawn and the return of the documents.

Tenders in plain sealed envelopes endorsed "Tender for Electrical Installations—Kingsley Estate," must be received by the Town Clerk, Town Hall, Ilford, not later than 4 p.m. on 21 Dec., 1954.

The Corporation do not bind themselves to accept the lowest or any tender.

(P 94)

CITY OF BELFAST
Electricity Department

TENDERS are invited as under:

STORES

The supply of the undermentioned materials:

Form No.

2. Transformer oil.
5. Carbon brushes.
10. 6,600 V compound filled armourclad switchgear.
11. Meters, instrument transformers, and ancillary equipment.
12. Electricity maximum demand indicators.
14. L.T. fuse units, service cutouts and accessories.
16. Vulcanised bitumen and paper insulated cables and joint boxes.
21. Electric cookers.
23. Street lighting fittings, steel and concrete poles and ancillary equipment.
25. Overhead line materials.
26. Mineral insulated copper covered cables and terminating accessories.
27. Steel conduit and tinned weak back ferrules.
29. Rubber insulated cables and flexible cords.
30. Lamps.
33. Nickel iron switch tripping batteries and charging equipment.
34. 6,600 V ring main and switch fuse units.
38. Medium voltage H.R.C. cartridge fuse links.
39. Imported red fir wood poles.

NOTE.—Forms Nos. 29 and 30 are in respect of materials which shall be supplied to any Department of the Corporation.

Forms of Tender may be obtained at the Electricity Department, East Bridge St, Belfast, on payment of a sum of ten shillings (non-returnable) for each form. Extra copies of the forms may be obtained at five shillings each (non-returnable). Cheques should be made payable to the Belfast Corporation Electricity Department.

All letters, catalogues, drawings, etc., accompanying tenders must be submitted in duplicate.

continued in next column

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Tenderers are advised that the Corporation conditions of contract only will apply. Any other conditions put forward by tenderers will not be accepted.

Latest time for receipt of Tenders—4 p.m. on Friday, 31 Dec., 1954.

CONDENSER TUBES, TUBE PLATE FERRULES AND PACKING; COAL CONVEYING PLANT

(*a*) The supply and delivery of condenser tubes, tube plate ferrules and packing (specification No. W.58).

(*b*) The supply, delivery and erection of coal conveying plant at Belfast Municipal Electric Power Station East (specification No. W.60).

Forms of Tender and specifications may be obtained at the Electricity Department, East Bridge St, Belfast, on payment of a deposit of two guineas in respect of item (*b*), which will be refunded provided a bona fide Tender is lodged and not withdrawn. Extra copies may be obtained at one guinea each; this sum will not be returnable. Cheques should be made payable to the Belfast Corporation Electricity Department. (No deposit is required in respect of item (*a*).)

Latest time for receipt of Tenders—4 p.m. on Friday, 31 Dec., 1954.

The following conditions apply to the above mentioned Tenders: Each Tender, in sealed envelope marked "Tender for..... Electricity Committee," and endorsed with the name and address of the tenderer, must reach the undersigned not later than the time specified.

An official receipt must be obtained for each Tender delivered by hand. Tenders sent by post should be registered.

The lowest or any Tender will not necessarily be accepted.

JOHN DUNLOP,
Town Clerk.

City Hall, Belfast.
P.O. Box 234.
29 Nov., 1954. (P 84)

APPOINTMENTS VACANT

Engagement of persons must be made through a Local Labour Office or Scheduled Employment Agency, if the applicant is a man aged 18-64, or a woman aged 18-59; unless the person concerned is excepted or the employment is in a managerial or professional capacity, or is otherwise excepted from the provisions of the Notification of Vacancies Order, 1952.

BRITISH ELECTRICITY AUTHORITY
Eastern Division

APPLICATIONS are invited for the following posts:

GENERAL ASSISTANT ENGINEER (SECTION)—TRANSMISSION DEPARTMENT AT DIVISIONAL HEADQUARTERS

Salary Class AX/DX, Grade 6, £600/£785 per annum plus London Weighting.

The commencing salary will depend upon experience and qualifications, but will be within the above range.

Applicants should preferably hold corporate or graduate membership of the Institution of Electrical Engineers or equivalent qualifications and have experience in the construction or operation and maintenance of high voltage overhead lines, cables and substation equipment up to 132 kV.

ASSISTANT ENGINEER (INSTRUMENTS)—RYE HOUSE GENERATING STATION

Salary Class G, Grades 12-10, £595/£720 per annum.

The commencing salary will depend upon experience and qualifications, but will be within the above range.

Applicants should have had a sound technical training and good practical experience in the construction, repair and testing of Generating Station instruments and automatic controls for mechanical services.

Applications, stating age, qualifications and experience should be sent to the Controller, British Electricity Authority, Eastern Division, Northmet House, Southgate, N.14, to arrive not later than 18 Dec., 1954.

W. N. C. CLINCH,
Controller.

(P 58)

YORKSHIRE ELECTRICITY BOARD
No. 5 (Wakefield) Sub-Area

Castleford District
CONSUMERS' ENGINEER

APPLICANTS, who must have had a sound practical training and considerable experience in the work of a Consumer's Engineer, will be required to give advice to all classes of consumer concerning the utilisation of electricity.

Experience is required in negotiations for supply; the interpretation and application of the I.E.E. Wiring Regulations and other regulations concerned with the testing and inspection of consumers' installations; tariffs; sales development; the control of staff and manual workers.

Salary—N.J.B. Class F, Grade 8, £715/£15/£760 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 5 (Wakefield) Sub-Area, Yorkshire Electricity Board, 1a Denby Dale Rd, Wakefield, not later than 16 Dec., 1954. (P 59)

GOLD COAST LOCAL CIVIL SERVICE
ELECTRICAL ENGINEERS, GOLD COAST

VACANCIES exist for Electrical Engineers in the Electricity Department of the Local Civil Service of the Gold Coast.

Duties are to take charge of, or assist in, the operation and maintenance of electricity supplies of voltages up to 11,000 V. Appointments are on contract for 2 tours in the salary range £1,130/£2,020 per annum point of entry depending on professional experience and age. A gratuity of £37. 10s., is payable for each completed 3 months' satisfactory service.

Free first class passages are provided for the officer, his wife, and up to 3 children under 13 years of age. Government quarters, if available are provided at a rental of £60/£90 per annum. Leave is granted at the rate of 7 days for each completed month of resident service after a tour of 18-24 months.

Candidates, between 28 and 45 years of age, should be A.M.I.E.E. or have passed or be exempt from Parts A and B of the examination for the Associate Membership of the Institution of Electrical Engineers and have served a recognised apprenticeship in Electrical Engineering. They should have had five years' experience in power generation, transmission and distribution and consumers installations, after obtaining the minimum professional qualifications.

Apply in writing to the Director of Recruitment, Colonial Office, Great Smith St, London, S.W.1, giving briefly age, qualifications and experience. Mention the reference number BCD/145/13/02/D10. (P 95)

EASTERN ELECTRICITY BOARD
Northmet Sub-Area

SENIOR SALES REPRESENTATIVE—STEVENAGE DISTRICT (REF. NO. 499)
175/54.R

CANDIDATES must be of good address and have had sound practical training, with experience in electrical installation work for domestic, commercial and industrial premises. A good knowledge of electric water heating and ability to prepare wiring specifications and estimates is essential.

Salary will be in accordance with Grade 2 (£485 by £20—£545) of the National Joint Council Salary Agreement and future salary and conditions of service will be in accordance with agreements made from time to time by the appropriate negotiating bodies.

The successful candidate will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Applications by letter stating age, education, qualifications and experience with details of present appointment and salary, should be submitted to the District Manager, Eastern Electricity Board, 38 High St, Stevenage, Herts, within fourteen days of the appearance of this advertisement. (P 81)

SOUTH WESTERN ELECTRICITY BOARD
FIRST ASSISTANT DISTRICT COMMERCIAL ENGINEER—EXETER

SALARY N.J.B. Class E, Grade 6—£755/£800 per annum.

Duties include the initiation of development schemes, the conduct of sales and publicity campaigns, the preparation of detailed wiring estimates, the organisation of installation contracting and the supervision and co-ordination of detailed work in the Service Centres. Qualifications leading to Corporate Membership of the I.E.E. desirable.

Application forms obtainable from the Manager, Devon Sub-Area, 57 Paul St, Exeter, should be returned by 15 Dec., 1954.

GENERAL ASSISTANT ENGINEER—BRISTOL DISTRICT

Salary N.J.B. Class J, Grade 12—£675/£720 per annum.

Duties relate to operation, maintenance and construction work in the District, including standby. Experience of underground and overhead H.V. and L.V. networks and substations, preferably in urban areas, is desirable and possession of H.N.C. necessary.

Application forms obtainable from the Manager, Bristol Sub-Area, Electricity Hse, Bristol 1, should be returned by 15 Dec., 1954. (P 72)

BRITISH ELECTRICITY AUTHORITY
Southern Division

APPLICATIONS are invited for a post as:

STATION CLERK,
MARCHWOOD GENERATING STATION
(Nr. Southampton—at present under construction).

Applicants should have had considerable experience in administrative and clerical work at a large generating station, including the preparation of wages sheets, stores records, and station costs.

Candidates should have had a sound general education, and preference will be given to those in possession of a recognised professional qualification, or equivalent.

Salary: N.J.C. Grade 5, £670/£730.

Special application forms, obtainable from P. D. A. Oliver, Divisional Secretary, 111 High St, Portsmouth, should be returned by 15 Dec., 1954. Please quote reference ET/ER.

PFC/NMH/130.
26 Nov., 1954. (P 82)

SOUTH WALES ELECTRICITY BOARD
require THIRD ASSISTANT ENGINEER (General) in the Central Sub-Area, Cardiff.

Salary—Class K, Grade 10 (£790 by £20—£850) of the N.J.B. Schedule.

Applications stating age, present position, salary, qualifications, experience and three referees, to be addressed to the Secretary to arrive by 11 Dec., 1954.

D. G. DODDS,
Secretary.
St. Mellons,
Cardiff. (P 80)

BRITISH ELECTRICITY AUTHORITY
South West Scotland Division

ASSISTANT SHIFT CHARGE ENGINEER CLYDE'S MILL AND DALMARNOCK POWER STATIONS

APPLICATIONS are invited for the positions of Assistant Shift Charge Engineer at Clyde's Mill and Dalmarnock Power Stations.

The post will be superannuable and the salary in accordance with Class "J," Grade 9, of the National Joint Board Agreement will be at the commencing rate of £790 per annum. Applicants should have attained the Higher National Certificate in electrical or mechanical engineering and have had power station control room experience.

Applications on Form AE.6 which may be obtained from the Divisional Office of the Authority, should be forwarded to the Divisional Secretary, 168 Broomhill Drive, Glasgow W.1, before Friday, 17 Dec. (P 57)

BRITISH ELECTRICITY AUTHORITY
North West, Merseyside & N. Wales Division

VACANCY No. 228/54/T—SHIFT CHARGE ENGINEER at Chadderton "A" Generating Station, nr. Oldham. Salary £715/£760 (E.7).

Applications, quoting Vacancy No., to Controller, British Electricity House, 825 Wilmslow Rd, Manchester 20, before 11 Dec. (P 75)

EAST MIDLANDS GAS BOARD
Leicester and Northants Division

ELECTRICAL SUPERVISOR—LEICESTER UNDERTAKING

APPLICATIONS are invited from skilled electricians for the appointment of Electrical Supervisor to the Leicester Undertaking. The commencing salary, which will be dependent upon the qualifications and experience of the successful applicant, will be within the range £500 to £665 per annum.

Applicants for the appointment should be practically conversant with all types of A.C. and D.C. motors and their control gear, be knowledgeable of the sizing and installation of power supplies, and have experience in the installation of paper insulated cables.

The Electrical Supervisor will be based at the Aylestone Rd Works and a house, adjacent to the Works, is available, if required, at a reasonable weekly payment under the terms of a Service Occupation Agreement.

The position is pensionable and the successful applicant may be required to pass a medical examination.

Applications stating age and present position, and giving full details of experience and type of work undertaken should be addressed to reach the undersigned not later than Saturday 11 Dec., 1954.

H. B. TAYLOR,
Divisional General Manager.
Millstone Lane,
Leicester.
24 Nov., 1954. (P 54)

BRITISH ELECTRICITY AUTHORITY
East Midlands Division

APPLICATIONS are invited for the following positions within the Division:

ASSISTANT SHIFT CHARGE ENGINEER
BURTON-ON-TRENT POWER STATION
Vacancy No. 180/54/ET

Applicants should have H.N.C. or equivalent qualification and had experience in Power Station operation.

Salary will be within Class E, Grade 9 (£635 by £15—£680 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications 9 Dec., 1954.

ASSISTANT SHIFT CHARGE ENGINEER
(BOILERHOUSE) LONGFORD POWER STATION, COVENTRY
Vacancy No. 181/54/ET

Applications are invited from suitably qualified Engineers to take charge of shift operation of Boiler House Plant.

Applicants must possess a sound technical training, have had good general engineering experience, a knowledge of the control and operation of large water tube boilers, ancillary plant and in the efficient combustion of fuels on Chain Grate Stokers.

The salary will be within Class G, Grade 9 (£715 x £15—£760 per annum) of the National Joint Board Schedule A.

Closing date for receipt of applications, 16 Dec., 1954.

These appointments will be pensionable within the terms and provisions of the British Electricity Authority and Area Boards Superannuation Scheme.

Applications should be submitted on the official form A.E.6/ACT which may be obtained from the Divisional Establishments Officer, British Electricity Authority, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated. Please quote Vacancy Number.

L. F. JEFFREY,
Divisional Controller.
26 Nov., 1954. (P 71)

BRITISH ELECTRICITY AUTHORITY
Midlands Division

GENERAL ASSISTANT ENGINEER is required in the System Operation Department at Headquarters, Birmingham. N.J.B. service conditions, superannuable appointment, salary within Schedule "C," Grade 6, commencing in range £600/£725, ultimately rising to £805 per annum.

Duties will be of a general statistical nature associated with the group operation of power stations, and the successful applicant will be required to carry out shift duties as necessary in the System Control room. Power station experience and appropriate technical qualifications will be considered advantages.

Apply, quoting Vacancy No. 833MD on form AE6, available from the Establishments Officer, 53 Wake Green Rd, Moseley, Birmingham 13, by 18 Dec., 1954. (P 77)

THE NORTH WESTERN ELECTRICITY BOARD

APPOINTMENT OF SENIOR DRAUGHTSMAN —(ELECTRICAL), CHIEF ENGINEER'S DEPARTMENT, AREA BOARD HEADQUARTERS

APPLICANTS should have had a good technical training and drawing office experience in the electrical design, layout and detailing of indoor and outdoor substations up to 33,000 V, together with the preparation of protection, schematic and wiring diagrams.

Preference will be given to holders of the O.N.C. or H.N.C in Electrical Engineering.

Salary within range £640/£740 p.a. Schedule "D," Grade 5, N.J.B. Conditions.

Applications to Establishment Officer, The North Western Electricity Board, Cheetwood Rd, Manchester 8, by 11 Dec., 1954.

APPOINTMENT OF ENGINEERING DRAUGHTSMAN, PRESTON

Applicants should state their education and training and specify what experience they have had in a Drawing Office. Experience in the preparation of electrical diagrams will be an advantage.

Salary within range £510 x £20—£630 p.a. Schedule "D," Grade 6, N.J.B. Conditions.

Applications to Sub-Area Manager, No. 4 Sub-Area, The North Western Electricity Board, 40/41 Lune St, Preston, by 11 Dec., 1954.

APPOINTMENT OF SECOND ASSISTANT DISTRICT ENGINEER, WHITEHAVEN DISTRICT

Applicants should have had experience in planning and estimating of schemes and operation and maintenance of both overhead and underground networks at voltages up to 33 kV. Applicants should preferably hold the H.N.C. (or equivalent) in Electrical Engineering. Practical experience of overhead line construction is desirable.

The successful candidate will be expected to undertake standby duties.

Salary Scale: £755 x £15—£800 p.a. Grade F.7, N.J.B. Conditions.

APPOINTMENT OF THIRD ASSISTANT ENGINEER (SYSTEM PLANNING) SUB-AREA ENGINEER'S DEPARTMENT, KENDAL

Duties will include assistance in the planning of H.V. and L.V. networks, including the design and application of protective gear and the specification of H.V. switchgear.

Experience in the calculation of system load flows and fault levels is essential, and applicants should preferably hold the H.N.C. (or equivalent) in Electrical Engineering. Some operational experience in the Electricity Supply Industry is desirable.

Salary Scale: £755 x £15—£800 p.a. Grade J.10, N.J.B. Conditions.

APPOINTMENT OF THIRD ASSISTANT DISTRICT ENGINEER, KENDAL DISTRICT

Applicants should be capable of preparing schemes and estimates for O/H and U/G construction up to 11 kV by both direct and contract labour. A knowledge of the usual Statutory and Planning requirements is essential. Possession of the H.N.C. in Electrical Engineering would be an advantage.

Salary Scale: £595 x £15—£640 p.a. Grade D.9, N.J.B. Conditions.

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Applications for the above posts to Sub-Area Manager, No. 6 Sub-Area, The North Western Electricity Board, Castle Green, Kendal, by 11 Dec., 1954.

APPOINTMENT OF FITTERS (ELECTRICAL) MACCLESFIELD AND NEW MILLS DISTRICTS

Rate of Pay: 45 pence per hour.
44-hour, 5-day week, N.J.I.C. Conditions.

Applicants should be experienced in the erection and maintenance of E.H.T. and L.T. Switchgear, Transformers and ancillary Substation equipment.

Application forms can be obtained from Sub-Area Manager, No. 7 Sub-Area, The North Western Electricity Board, Chapel St, Hazel Grove, Cheshire, and must be returned to him by 11 Dec., 1954.

APPOINTMENT OF SENIOR SERVICE CENTRE ASSISTANT (MALE) BOLTON DISTRICT

Applicants should have experience of electrical appliances and some knowledge of electricity tariffs. Duties will include receiving of accounts payments. Knowledge of display and window dressing will be an advantage. Preference given to applicants prepared to take approved courses of study in Electrical Engineering and already holding the E.D.A. Salesmanship Certificate.

Salary Scale: £485/£545 p.a. Grade 2, N.J.C. Conditions.

Applications to Sub-Area Manager, No. 2 Sub-Area, The North Western Electricity Board, National Buildings, St. Mary's Parsonage, Manchester 3, by 11 Dec., 1954. (P 56)

THE ELECTRICITY BOARD
Belize, British Honduras

ELECTRICAL ENGINEER

APPLICATIONS are invited for the appointment of an Electrical Engineer in the service of the Electricity Board, Belize, British Honduras.

The present supply system which is 110/220 V, 3-wire D.C. is to be changed over to 6,600 V and 220 V, 3-phase, 60 cycles, A.C., three new 800 kW diesel-alternator sets are to be installed and two existing 400 kW diesel sets converted from D.C. to A.C.

The Engineer will be required, initially, to supervise the changeover of the distribution system from D.C. to A.C. and the erection of the generating sets and ultimately to take charge of the operation and maintenance of the distribution system and the generating plant.

Candidates should be Corporate Members of the Institution of Electrical Engineers or hold qualifications exempting them from the Institution examination and must have had considerable experience in the construction and operation of L.V. overhead distribution networks and H.T. overhead lines up to 6,600 V. They must also have had some experience in the erection and operation of diesel engines up to 1,000 h.p.

The appointment will be on a salary scale of £1,225 per annum rising by annual increasements of £75 to a maximum of £1,375 per annum. Details of Provident Fund, 6%.

A car allowance of £5 per month will be paid.

The appointment will be for a period of 3 years in the first instance terminable by three months' notice on either side and may be renewable by mutual consent.

Free passages will be provided for the officer and his family up to four full passages, on first appointment, on termination of the agreement and for long leave in the United Kingdom.

Leave is earned at the rate of sixty days per year of residence in service and may be accumulated. (Earned leave to the United Kingdom may be taken after three years' service).

Applications endorsed "Electrical Engineer, Belize," stating age, qualifications and experience should be forwarded within 21 days of the date of this advertisement to the undersigned who will communicate with candidates selected for further consideration. Preece, Cardew and Rider.
8-12 Queen Anne's Gate,
Westminster, S.W.1. (P 74)

BRITISH ELECTRICITY AUTHORITY
London Division

APPLICATIONS are invited for the following superannuable posts. Conditions of service in accordance with the revised N.J.B. Agreement, Schedule A or C. Salary includes London Allowance. Qualifications entitling to Graduate Membership of the I.E.E. or I.Mech.E. an advantage.

GENERAL ASSISTANT ENGINEERS GROUPS 2 AND 3 HEADQUARTERS
Vacancy No. 54/993

Applicants should possess a sound technical training and duties will include assistance in statistics, technical returns, plant investigation and routine matters allied to Groups 2 and 3 Generating Stations. Salary in scale Class AX/EX, Grade 6=£630/£845. 5s. p.a.

ASSISTANT SHIFT CHARGE ENGINEER STEPNEY GENERATING STATION
Vacancy No. 54/994

Experience of pulverised fuel firing an advantage. Salary—Class F, Grade 9=£708. 15s. p.a.

Applications, quoting vacancy number, may be made on form obtainable from Divisional Secretary, British Electricity Authority, London Division, P.O. Box 136, Generation House, Great Portland St, W.1, and be received within 14 days of this advertisement. (P 69)

BRITISH ELECTRICITY AUTHORITY
South Wales Division

Vacancy No. 112/54

APPLICATIONS invited for superannuable N.J.B. appointment of SHIFT CHARGE ENGINEER at Carmarthen Bay Power Station. Salary K7, £975 x £25—£1,050 per annum.

Applicant should have obtained H.N.C. and served a regular apprenticeship. Operating experience in a modern Power Station essential.

Application forms obtainable from Secretary, South Wales Division, British Electricity Authority, Twyn-y-fedwen Rd, Gabalfa, Cardiff, to be returned by 13 Dec., 1954. (P 60)

SOUTH EASTERN ELECTRICITY BOARD

SHOWROOM SUPERVISOR (MALE)
Woking District

SALARY £670 by £20—£730 p.a. under N.J.C. Agreement, Grade 5. Superannuable. The person appointed will be required to take charge of the Woking Showroom and will be responsible to the District Commercial Engineer for the control of showroom staff. Experience in all branches of showroom work is essential.

Applications naming 2 referees, on forms from J. C. Poole, A.M.I.E.E., Woking Manager, SEEBoard, 4 Chobham Rd, Woking, by 15 Dec., 1954.

DEMONSTRATOR/SHOWROOM ASSISTANT (FEMALE)
Woking District

Salary £400/£490 p.a. under N.J.C. Grade 1. Superannuable. Applicants should have showroom experience and be capable of demonstrating electrical appliances both in Showrooms and on consumers' premises. Possession of E.A.W. certificate an advantage.

Applications naming 2 referees, on forms from J. C. Poole, A.M.I.E.E., Woking Manager, SEEBoard, 4 Chobham Rd, Woking, to be returned by 15 Dec., 1954.

DEMONSTRATOR (FEMALE)
West Kent District

Salary £400 by £20—£480 by £10—£490 p.a. under N.J.C. Grade 1, plus London Weighting. Superannuable. Applicants should possess a recognised diploma or certificate in domestic science and the E.A.W. Certificate. The successful applicant will be required to conduct lectures and demonstrations, advise consumers, and generally assist in service centres.

Applications on forms from P. S. Watson, M.I.E.E., West Kent District Manager, SEEBoard, 270 High St, Orpington, Kent, by 15 Dec., 1954.

A. L. BURNELL,
Secretary.
(P 73)

SOUTHERN ELECTRICITY BOARD

ASSISTANT ENGINEER (MAINTENANCE AND OPERATION)

GREENFORD District of No. 1 (Southall) Sub-Area. Salary N.J.B. Class F, Grade 12 (£582. 15s. per annum, inclusive of London Allowance). N.J.B. Conditions of Service.

The duties of the post will be to assist generally with the maintenance and operation of H.V. and L.V. overhead and underground distribution systems working at voltages up to 33,000. The qualifications are sound technical training and experience; preference will be given to those applicants who possess suitable technical qualifications. The appointment will involve standby duties.

Applications on forms obtainable from the Sub-Area Secretary, 2-6 Windmill Lane, Southall, Middlesex, and returned to him in envelopes suitably endorsed, not later than 17 Dec., 1954.

SUB-AREA FIELD ENGINEER (CONSTRUCTION)

North Sub-Section, Farnborough, of No. 3 (Portsmouth) Sub-Area. Salary N.J.B. Class K, Grade 13 (£675 x £15—£720 per annum). N.J.B. Conditions of Service.

The duties of the post will be to carry out the installation and erection of plant, equipment and overhead lines, the laying of mains and other constructional work by direct labour on distribution systems up to and including 33,000 V. Preference will be given to those applicants who possess technical qualifications up to A.M.I.E.E. standard.

Applications on forms obtainable from the Sub-Area Secretary, Lower Drayton Lane, Cosham, Portsmouth, and returned to him in envelopes suitably endorsed, not later than 17 Dec., 1954.

The successful candidates for the above appointments will be required to contribute to the B.E.A. and Area Boards' Superannuation Scheme, if eligible. (P 70)

WARWICKSHIRE COUNTY COUNCIL

ARCHITECT'S DEPARTMENT

APPLICATIONS are invited for an ELECTRICAL ENGINEERING ASSISTANT on grades APT II-III (£560/£725). Applicants should be experienced in the preparation of electrical installation layouts and specifications for public buildings and in particular schools, and should be capable of working under limited supervision.

The appointment is on the established staff and subject to the provisions of the Local Government Superannuation Acts, 1937-1953 and the successful applicant will be required to pass a medical examination.

Application is to be made on a form which can be obtained from G. R. Barnsley, F.R.I.B.A., County Architect, Shire Hall, Warwick.

L. EDGAR STEPHENS,
Clerk of the Council.

Shire Hall,
Warwick.
3 Dec., 1954. (P 97)

BRITISH ELECTRICITY AUTHORITY
South Western Division

TECHNICAL STAFF VACANCIES

(*a*) SHIFT CHARGE ENGINEER, Castle Meads Generating Station—N.J.B. "E"7. £715/£760.

(*b*) STATION SHIFT CONTROL ENGINEER, Plymouth "A" Generating Station. N.J.B. "F"10, £635/£680.

Superannuation.

Applicants for (*a*) should have had considerable experience in a modern generating station. Graduate or Corporate Membership of a recognised Engineering Institution or equivalent desirable.

For (*b*) applicants should possess good technical qualifications, and have had training and experience in the control and operation of steam generating plant and main switchgear.

Applications on Form A.E.6/ACT, obtainable from the Divisional Secretary, 26 Oakfield Rd, Bristol 8, should be completed and returned by 13 Dec., 1954.

Please state clearly for which appointment you wish to be considered. (P 55)

BRITISH ELECTRICITY AUTHORITY
North Eastern Division

APPOINTMENT OF GENERAL ASSISTANT ENGINEER (MECH.)—GENERATION (CONSTRUCTION) DEPT.

APPLICATIONS are invited for the appointment of General Assistant Engineer (Mech.) in the Generation (Construction) Department with Headquarters at Carliol House, Newcastle upon Tyne.

Applicants should have had some experience in the mechanical aspects of Power Station Construction and should possess a Higher National Certificate or equivalent qualification.

The salary for the appointment (which is superannuable) will be in accordance with Grade 6, Schedule "C," of the National Joint Board Agreement (£600/£765 per annum) and will commence at a point commensurate with qualifications and experience.

Forms of application may be obtained from Divisional Establishments Officer, British Electricity Authority, North Eastern Division, Carliol House, Newcastle upon Tyne 1, to arrive not later than 18 Dec., 1954. (P 78)

MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable posts:

SECOND ASSISTANT DISTRICT ENGINEER, STRATFORD-ON-AVON DISTRICT, WORCESTER AND DISTRICT SUB-AREA

Experience necessary in all branches of distribution work including construction, operation and maintenance of high and low voltage underground and overhead distribution systems. Experience on changeover work would also be an advantage. Technical qualifications desirable. Salary £675/£720 per annum, N.J.B. Class D, Grade 7. Apply, in writing, within fourteen days stating age, experience, present salary and position, to Mr R. Mallet, Sub-Area Manager, Midlands Electricity Board, Whittington, Worcester.

GENERAL ASSISTANT DISTRICT ENGINEER, DEAN FOREST DISTRICT, CENTRAL GLOUCESTERSHIRE SUB-AREA

Applicants should have had a sound technical training and experience in the construction, maintenance and operation of overhead and underground systems and substations. Technical qualifications desirable. Salary £515/£560 per annum, N.J.B. Class D, Grade 11. Apply, in writing, within fourteen days stating age, experience, present position and salary to Mr D. Holt, Sub-Area Manager, Midlands Electricity Board, 126 London Rd, Gloucester. A. Stephens, Secretary. (P 93)

UGANDA ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments on the permanent staff of the Board in Uganda.

ELECTRICAL FITTER with experience in the installation and maintenance of outdoor and indoor substations and associated H.V. switchgear, transformers and other equipment. Experience with voltages up to 132 kV would be an advantage.

LINESMAN with experience in construction and maintenance of wood pole lines up to 33 kV. Experience of work on steel tower lines up to 132 kV an advantage. Duties may include installation of transformers, erection of switchgear and training of African linesmen.

Commencing salary about £990 according to age and experience in scale rising to £1,110 and with proficiency bar to £1,260. Free partly furnished accommodation, medical attention and passages. Leave on full pay after first three year contract. Single candidates preferred or, if married, with small family.

Apply for form of application and further information to London Office, Uganda Electricity Board, 27 Regent St, S.W.1.

Completed forms to reach the London Office before 10 Dec., 1954.

C. R. WESTLAKE,
Chairman.
(P 76)

Box No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London, W.C.2.

LONDON COUNTY COUNCIL

PADDINGTON TECHNICAL COLLEGE, as soon as possible, TEACHER for some of the following subjects to Nat. Cert. and C. and G. classes. Principles of Electricity, Electrical Installation, Theory and Practical, Engineering Science, Maths. Applicants should have Higher National Certificate in Electrical Engineering and some experience in electrical installation work. The post is Grade A but Grade B will be considered if suitable candidate. Burnham F.E. salary scale Grade A, £486 x £18—£887. Grade B, £561 x £25—£982, commencing and maximum according to age, qualifications and experience. Application forms from Secretary at College, Saltram Crescent, W.9, returnable by 17 Dec., 1954. (P 66)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

ENGINEERING DRAUGHTSMEN required in the Board's No. 1 Sub-Area Headquarters, 24 Hatton Garden, Liverpool 3. Salary within the range £510/£630 p.a. (N.J.B. Schedule "D," Grade 6), according to experience.

Applicants should be experienced in either (*a*) layout of electrical switchgear and substations, or (*b*) building work as applied to industrial or commercial premises. Possession of not less than Ordinary National Certificate will be an advantage.

The appointments are superannuable and subject to medical examination.

Applications should be forwarded to the Manager at the above address. (P 47)

BRITISH ELECTRICITY AUTHORITY
North Eastern Division

GENERAL ASSISTANT ENGINEER (SECTION) TRANSMISSION DEPARTMENT, MALTON

APPLICATIONS are invited for the appointment of General Assistant Engineer (Section) in the Transmission Department with headquarters at Malton.

Applicants should have had a good technical education and be experienced in the operation and maintenance of H.V. transmission systems.

The salary will be in accordance with the National Joint Board Agreement, Grade 5, Schedule "C" (£675/£840 per annum) and will commence at a point commensurate with qualifications and experience.

Forms of application may be obtained from Divisional Establishments Officer, British Electricity Authority, North Eastern Division, Carliol House, Newcastle upon Tyne, to whom they should be returned to arrive not later than 18 Dec., 1954. (P 79)

THE SOUTH WEST SCOTLAND ELECTRICITY BOARD
Ayrshire Sub-Area

APPLICATIONS are invited for the undernoted Engineering appointments.

(*a*) GENERAL ASSISTANT DISTRICT ENGINEER—AYR DISTRICT

Applicants should preferably possess a Higher National Certificate in Electrical Engineering or its equivalent and have experience of operational work in an Electricity Supply Authority.

Salary and conditions in accordance with the National Joint Board Agreement, Schedule "A," Grade 11, Class "E," £555/£600 per annum subject to statutory deductions which include income tax and superannuation.

(*b*) JUNIOR ENGINEER—KILMARNOCK DISTRICT

Salary and conditions in accordance with the National Joint Board Agreement, Schedule "A," Grade 13, Class "E," £475/£520 per annum subject to statutory deductions which include income tax and superannuation.

Forms of Application may be obtained from the undersigned or any other Sub-Area Manager and should be returned to me duly completed with any additional information not later than 14 Dec., 1954.

A. E. ROOTS,

Greenholm St,
Kilmarnock.
29 Nov., 1954. (P 98)

LONDON ELECTRICITY BOARD

ARCHITECTURAL DRAUGHTSMEN

APPLICATIONS are invited for the above positions in the Architect's Section of the Chief Engineer's Department in Central London.

Applicants should be neat draughtsmen and preferably have had several years' experience in an Architect's office.

The post is graded under Schedule "D" of the National Joint Board agreement as Grade 6—£458/£595. 7s. per annum, inclusive of London Allowance.

Application forms obtainable from Personnel Officer, 46 New Broad St, E.C.2, to be returned within fourteen days of the publication date of this advertisement. Please enclose addressed envelope and quote ref.: V/1785/T. on envelope and all correspondence. (P 20)

TRANSFORMER DESIGNERS AND DESIGNER-DRAUGHTSMEN

BRUCE PEEBLES AND CO., LTD., ENGINEERS, EDINBURGH 5, have vacancies in their Transformer Department for the following appointments:

(*a*) DESIGN ENGINEER with experience of transformers up to 10,000 kVA and interested in larger high voltage units.

(*b*) DESIGN ENGINEER with experience of, and particularly interested in, transformers up to 1,000 kVA.

(*c*) DESIGNER-DRAUGHTSMEN capable of undertaking complete electrical and mechanical layout of large high-voltage transformers and supervising detail work.

Application is also invited from Graduates, preferably with post graduate Works experience, to undertake design and development associated with large power transformers.

Salaries commensurate with experience and qualifications; permanent appointment, with Pension and Production Bonus Schemes; five-day week; assistance in obtaining house accommodation.

Applications to Mr R. W. Flux, Manager, Transformer Department, at the above address. (P 91)

Electrical Designer

required by established firm of motor manufacturers.

Must have practical experience in design of AC and DC motors up to 200 h.p. also alternators.

Applicants should state age, experience and salary expected to—Box No. 4049, Electrical Times. (P 37p)

APPLICATIONS are invited for the position of ASSISTANT FOREMAN with practical working experience of extrusion of rubber covered and plastic covered cables. Permanent position. Pension scheme. Applicants should give full details of age, experience and salary required.—Box No. 4055, Electrical Times. (P 43)

APPRENTICE SUPERVISOR to assist with the co-ordination of technical studies with practical training in workshops and offices for technological and technician apprentices. Applications, stating salary expected, from qualified engineers, with previous industrial and/or service training experience to The Manager, Education Department, Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester 17. (P 26)

A SENIOR DRAUGHTSMAN is required by a Company in the Cardiff area manufacturing electrical rotating machinery 1—100 h.p. The Company would prefer to appoint a man with previous experience in this field and will be prepared to offer an attractive salary to such an applicant. Congenial working conditions; non-contributory superannuation scheme; five-day week. Applications in the first instance to—Box No. 4047, Electrical Times. (P 36)

ALLEN WEST AND CO., LTD., Brighton 7, require EXPERIENCED MEN for their Engineering Department. Must have had experience with electrical control gear manufacturers and be capable of engineering control schemes involving contactor type gear for all industrial applications. Replies with technical qualifications and salary required, to Mr E. S. Heathcote. (P 25)

DRAUGHTSMEN

THE ENGLISH ELECTRIC CO., LTD., Liverpool Works, have vacancies in their Transformer Department for Senior Draughtsmen to work on Medium and Large Power Transformers. Previous experience in this field is not essential and men with a good knowledge of the design and detail of welded fabrications, or any kind of medium mechanical equipment, are invited to apply. Pensionable and progressive positions are offered to men with initiative, and housing assistance will be given to selected applicants. Write giving full details of age, qualifications, experience, and when available for interview for which travelling expenses will be paid, to Dept. C.P.S., 336/7 Strand, W.C.2, quoting Ref. 161F.

(P 65p)

AN OPPORTUNITY occurs in progressive manufacturing concern in London area for ENGINEER, aged 25/35, with electrical or physicist degree, on development and research work on high frequency telecommunication cable and associated testing equipment. Salary will be commensurate with qualifications and experience. Apply giving full particulars to—Box No. 4059, Electrical Times. (P 64)

APPLICATIONS are invited for the position of ASSISTANT in Quality Control and Testing Department of Electric Cable Manufacturers, with practical experience of extrusion of rubber covered and plastic covered cables. Permanent position. Pension scheme. Applicants should give full details of age, experience and salary required. —Box No. 4057, Electrical Times. (P 44)

ELECTRICAL DESIGNERS

Are you experienced in the design of generating and electrical distribution systems?

We require men with Higher National Certificate, or equivalent, for interesting work in the designs section of our laboratories which specialise in aircraft electrical generating systems and equipment. Additional experience in aircraft wiring and distribution an advantage but not essential. This interesting work brings the successful applicants into contact with all phases of aircraft electrical engineering.

Write as fully as possible, stating your age and experience to Group D, Personnel Dept., Rotax Ltd., Chandos Road, Willesden Junction, London, N.W.10.

(P 45p)

VENNER LIMITED
require

(*a*) ELECTRONIC ENGINEER
conversant with design and manufacture of prototype transmitters, receivers, etc.

(*b*) ELECTRICAL ENGINEER
for development work on small generators.

Candidates should be suitably qualified.

Salaries and conditions for these staff vacancies are good, and there is a Pension Scheme. Applications should be addressed to: Personnel Manager, Venner Limited, New Malden, Surrey. (MALden 2442). (P 85p)

BRITISH ELECTRICITY AUTHORITY, Generation Design Branch, Headquarters, London, invite applications for the following vacancies in the Station Design and Layout Sub-Branch which is concerned with the investigation and co-ordination of proposals for the design and layout of the Authority's Power Stations:

PRINCIPAL ASSISTANT ENGINEER

Candidates should possess an honours degree in engineering and/or be corporate members of either the I.Mech.E. or the I.E.E. and must have wide experience in a senior position in the design and layout of large modern power stations. A knowledge of operation and/or construction of power stations would be an advantage.

The successful candidate will be required to take charge of a group of engineers and must therefore possess qualities of leadership.

Salary N.J.M. Scale 4, £1,650/£1,800 p.a. inclusive according to qualifications and experience.

THIRD ASSISTANT ENGINEER

Candidates should possess an honours degree in engineering and/or the requisite qualifications for corporate membership of either the I.Mech.E. or the I.E.E., and should have experience in the design and layout of large modern power stations.

Salary N.J.B. £908/£1,125 p.a. inclusive, according to qualifications and experience.

Forms from D. Moffat, Director of Establishments, Winsley St, London, W.1, to be completed and returned by 13 Dec., 1954. Quote Ref.: ET/545. (P 41)

CONTACTOR SWITCHGEAR LTD. ENGINEERS required for both Engineering and Estimating Departments for control gear applications up to 1,000 h.p. low and high tension.

The Company operates a contributory pension scheme and will share cost of removal in approved cases.

Applicants should have completed their National Service and preferably not over 45.

Write in confidence stating age, experience and salary required to the Secretary, Blakenhall, Wolverhampton. (P 88)

DRAUGHTSMAN with experience of Electro-Mechanical Instrumentation required immediately for interesting work in connection with Government and Commercial requirements in new and pleasant Drawing Office. National Certificate an advantage but not essential. Excellent conditions, Pension Scheme, 5-day week. Apply to General Manager, Hendrey Relays Limited, 392 Bath Rd, Slough, Bucks. (P 86)

DRAUGHTSMEN required for Automatic Electric Control Gear; 5-day week, excellent working conditions; Canteen facilities; convenient transport; Incentive Bonus; Superannuation Scheme; salary according to qualifications, ability and experience. Apply Assistant Secretary, Watford Electric and Mfg. Co., Ltd., Watford, Herts. (P 29)

DRAUGHTSMAN required for preparation of Drawings in connection with Overhead Line Contracts. References required. Apply in writing, stating salary required and when available for employment, to Reference S.L.R., B. French Ltd., Pike Mills, Green St, Kidderminster. (P 23)

DUE to expanding business ELECTRICAL ENGINEER SURVEYOR required for inspection of electrical plant. H.N.C. with practical experience essential. Salary £540 p.a. rising after 10 years to £785. Pension (Non-contributory). Area Sheffield/North Midlands. Apply Manager, Engineering Department, General Accident Assurance Corporation, 99 Aldwych, London, W.C.2. (P 63)

DRAUGHTSMEN, Ewbank and Partners Ltd., Engineering Consultants, have vacancies for Mechanical Engineering Draughtsmen experienced in Power Station design and layout, pipework, circulating water systems, some knowledge coal and ash handling plants an advantage but not essential. Vacancies also exist for Electrical Engineering Draughtsmen experienced in Power Station and Substation distribution systems. The positions are permanent and pensionable, five-day week, free lunches. Write to Personnel Officer, 10/11 Grosvenor Place, London, S.W.1, stating age, details of experience, salary required. Out of London area, 3rd class return fare paid to those interviewed by appointment. (P 28)

ELECTRICAL DRAUGHTSMAN required, capable of setting out Power and Lighting Installations, with all diagrams, etc.

Apply, stating age, with copies of references, to—Box No. 4061, Electrical Times. (P 92)

ENGINEER, aged 25 to 35, preferably having Higher National Certificate, required for the maintenance of electronic equipment and the testing and alignment of new instruments used for quality control and automatic testing of all types of telecommunication cables. Apply giving full particulars to—Box No. 4039, Electrical Times. (P 30)

ESTABLISHED firm of electrical contractors in the Manchester area require the services of an ESTIMATING ENGINEER for industrial and commercial electrical installation contracts. Only those candidates who have had some practical and drawing board experience and who are in a position to prepare competitive estimates and schemes need apply. Reply in confidence, giving some indication of salary, age and previous experience.—Box No. 4045, Electrical Times. (P 35)

GRADUATE ELECTRICAL ENGINEER required in the Engineering Organisation of British Insulated Callender's Cables Limited at 38 Wood Lane, London, W.12, for development work on high voltage cables and accessories in the voltage range of 33 kV and upwards. Previous experience of cable work is not essential although it would be helpful. Pension Fund. 5-day week. Apply in writing, stating age, qualifications and experience and quoting reference number L.43/54 to Staff Officer, British Insulated Callender's Cables Limited, 21 Bloomsbury St, London, W.C.1. (P 40)

JOINTERS required for Aerodrome work in South West England and Isle of Wight, for up to 11 kV and Telephone cables. Apply: Drake and Gorham (Contractors) Ltd., Pearl Assurance House, Royal Parade, Plymouth. (P 22)

JUNIOR ELECTRICAL DRAUGHTSMAN required for Drawing Office near centre of Birmingham. Give full details of experience and salary required. Five-day week. canteen facilities. Lodge-Cottrell Ltd., George St Parade, Birmingham 3. (P 48)

LAYOUT DRAUGHTSMAN required by Consulting Engineers for electrical layout work including HV and LV outdoor substations, indoor switchgear and cable diagrams.

Applicants should possess or should be studying for H.N.C. or equivalent. Salary in accordance with qualifications. Apply in writing reference KJB/RFS to Messrs Kennedy and Donkin, 12 Caxton St, Westminster, London, S.W.1. (P 32)

CONTRACT DEPARTMENT ENGINEER
for Hong Kong

Experienced in estimating and supervising all usual types of electrical installation work including substations and the laying and jointing of main cables. Good terms and employment conditions are offered. Detailed application should be sent to:

Employment and Welfare Officer,
JOHNSON AND PHILLIPS LTD.
Victoria Works, Charlton, S.E.7
(P 42p)

LEADING OIL COMPANY requires one ELECTRICAL ENGINEERING DRAUGHTSMAN for work in the Middle East. Age 25-30 years. Candidate should possess the Ordinary National Certificate in Electrical Engineering or have equivalent qualifications. An engineering apprenticeship is required which includes 3 years' practical experience in the shops followed by 3-5 years in the Drawing Office on electrical installations for Process Plants, Workshops and/or Factories. Attractive salary plus generous allowance in local currency, free passages out and home, free medical attention, kit allowance, good leave arrangements. Pension Scheme. Write, stating age and full details of qualifications, quoting F.500, to Box 1310, c/o 191 Gresham House, E.C.2. (P 87)

MERZ AND MCLELLAN require MECHANICAL ENGINEERING DRAUGHTSMEN for their Esher Office. Applicants should be fully experienced in layout work, preferably in connection with Steam Power Station design. Salaries offered will be fully appropriate to applicants' experience. Pension scheme. Apply in writing to Merz and McLellan, "Milburn," Esher, Surrey. (P 62)

MATHER AND PLATT LTD., require the services of a SENIOR MECHANICAL DESIGNER, age 35-40, with experience of mechanical design of medium and large-sized rotating electrical machines. Selected applicant will be offered good salary commensurate with experience and will be eligible for first-class non-contributory pension scheme. Write to Employment Manager, Park Works, Manchester 10. (P 27)

REPRESENTATIVE to cover Southern Electricity Board area. Applicants should be resident on the territory, have good contacts with architects, wholesalers and contractors, and possess their own car. This is an interesting and worthwhile post for a man with right background. Write in confidence to—The Sales Manager, M.K. Electric Limited, Wakefield St, London, N.18. (P 24)

REPRESENTATIVE required for London and South Coast Area, based at our London Office, with good contacts amongst Manufacturing Electrical Engineers, Electricity Boards, Wholesalers and Engineering Establishments. Preference will be given to applicants having experience of Ministry and Government Departments requirements. Progressive post (superannuated) available for keen and energetic man not older than 45, car an advantage. Salary, Bonus and Expenses paid. Apply in writing only, giving full particulars of experience, age and salary required, to the Secretary, William McGeoch and Co., Ltd., Electrical Engineers, 46 Coventry Rd, Birmingham 10. (P 90)

THE ENGLISH ELECTRIC CO., LTD., require SALESWOMEN DEMONSTRATORS in the London, Cardiff, Bristol, Ipswich and Leeds Areas. Applicants should have proved sales ability, domestic science training and a good knowledge of domestic electrical appliances. Please apply giving full details of experience and qualifications, etc., to Dept. C.P.S., 336/7 Strand, W.C.2, quoting Ref. 984G. (P 89)

FERRANTI LTD.
(Meter Dept.) Hollinwood

have the following vacancies:

(1) DEVELOPMENT ENGINEERS of approximately graduate status in Electrical Engineering or Physics. The work includes a variety of electrical and electro-mechanical problems arising in the design and development of electrical measuring devices with emphasis on integrating electricity meters. Ref.: MDE.

(2) DESIGN DRAUGHTSMEN of approximately H.N.C. standard in Mechanical or Electrical Engineering, preferably with previous experience in the design of small precision mechanisms. Ref.: MDO.

(3) PLANNING ENGINEERS with previous experience of planning and work study in light engineering. Ref.: MPE.

Permanent staff appointments with pension benefits. Application forms from

Mr T. J. Lunt, Staff Manager, Ferranti Ltd., Hollinwood, Lancs.

Please quote appropriate reference.

SHIFT CONTROL ENGINEERS required by The Steel Company of Wales Ltd. (Steel Division), Port Talbot, in their Electrical Engineering Department.

The successful candidates will be responsible for the control and operation of electricity supplies and distribution systems connected with a large integrated iron and steel plant.

A sound technical knowledge and previous experience with heavy industrial plant essential.

Higher National Certificate or equivalent desirable.

Those wishing to apply should write for official Application Form to the Personnel Superintendent, The Steel Company of Wales Ltd., P.O. Box No. 3, Port Talbot, Glam. (P 33)

THE SWITCHGEAR CONTRACTS Department of The English Electric Co., Ltd., Stafford, has vacancies for SENIOR ENGINEERS. Applicants should have recognised technical qualifications. A knowledge of modern switchgear and control gear practice, or of the protection and control of HV systems, transformers and generators or large industrial machine drives, is desirable. Drawing office, test or operating experience will be considered. The posts are permanent, progressive and pensionable. Please write to Dept. C.P.S., 336/7 Strand, W.C.2, quoting reference 446G. (P 34)

THE ASSOCIATED ETHYL COMPANY LIMITED wish to appoint three GRADUATE ENGINEERS to the electrical section of Engineering Department at Ellesmere Port, Cheshire.

Opportunity is available for work in the following fields:

Design, construction and commissioning of large H.V. and L.V. industrial systems.

Commissioning and operational problems in electrolytic processes.

Design of electric circuits associated with process control.

Administration planning and control of electrical design work, specifications and standards.

The Department is expanding and to the candidate whose qualifications and personality indicate ability to progress, an attractive salary and considerable prospects are possible.

Applications stating age, qualifications and experience should be addressed to the Deputy Manager—Personnel, The Associated Ethyl Company Limited, Ellesmere Port, Cheshire. (P 50)

WEST LONDON CONTRACTOR has a vacancy for ENGINEER. Experience in control of labour. O.H. Line and U.G. Jointing up to 33 kV. Permanent. Superannuation Scheme. In confidence.—Box No. 4053, Electrical Times. (P 38)

THE BRITISH THOMSON-HOUSTON COMPANY LIMITED

has vacancies on its design and development staffs at Rugby, Birmingham, Coventry, Leicester, and Newcastle-under-Lyme, for ELECTRICAL and MECHANICAL ENGINEERS with experience in the following fields:

INDUSTRIAL ELECTRONICS (all modern applications of electronics).

ELECTRICAL MACHINE DESIGN (A.C. and D.C., large, intermediate and fractional h.p. sizes).

INDUSTRIAL APPLICATION OF ELECTRICAL EQUIPMENT (steel works, mining, paper mills, machine tools and other industries).

TRANSFORMER DESIGN (large E.H.T., intermediate and small).

AIRCRAFT ELECTRICAL EQUIPMENT (A.C. and D.C. generators, motors, contactors, starters, etc.).

The openings provide good prospects for young men with technical ability and education in a large rapidly growing industry with ample opportunities for gaining experience in new fields. Young men with honours engineering or science degrees or their equivalents, and engineers with practical mechanical design experience on the drawing board, are required. Applications should be made to the Chief Electrical Engineer's department, the British Thomson-Houston Co., Ltd., Rugby, together with particulars of technical qualifications, training and experience. (P 21p)

TELEVISION ENGINEERS required by rapidly growing Radio and Television Renting Organisation covering South Wales, West Country, South Coast, Lincolnshire and Yorkshire. Permanent and progressive appointments for experienced men. Superannuation and Sick Benefit Schemes. Please give full details of past experience and qualifications to the General Manager, Rentaset Ltd., Head Office, 158/159 Rodbourne Rd, Swindon, Wilts. (P 49)

Insulation Engineers Required

Must have knowledge of all modern organic and inorganic insulating materials used in the electrical engineering industry. Previous experience in the application of such material to small rotating machines is essential. Practical experience in the winding of rotors and stators is desirable. This interesting work brings the successful applicant into contact with all phases of aircraft electrical engineering.

Write as fully as possible, stating your age and experience to the Personnel Dept., Rotax Limited, Chandos Road, Willesden Junction, London, N.W.10.

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ARMATURE REWINDING service to the trade. Vacuums, Drills, Grinders, Hood Dryers, Dental Motors. Vacuum cleaner and drill armatures replaced from stock 24-hour service. Every job guaranteed. All vacuum cleaner parts, hoses, etc., in stock for any make. Apex washer agitator shafts stocked.—Regam Electric Cleaner Service 95 Park Lane, Leeds 1. (P 5)

A.C. and D.C. MOTOR REWINDS and REPAIRS. Prompt service fully guaranteed. Edgware 5566 (4 lines).—Service Electric Co., Ltd., Stanmore, Middx. (P 4)

FISHER FOUNDRIES LTD., Greet, Birmingham 11, for Machine Moulded Precision Castings in gun metal and soft grey iron. Tel.: Victoria 0197. (P 6)

WANTED

WANTED, for prompt cash, ferrous and non-ferrous SCRAP; also plant for dismantling. Buyers of secondhand machinery and plant for re-use.—W. and H. Cooper Ltd. 176 Brady St, Bethnal Green, E.1. (P 1)

WANTED. ROTARY CONVERTERS, any size.—Universal, 221 City Rd, London, E.C.1. (P 3)

PATENTS

THE Proprietors of Letters Patent No. 598265 relating to ELECTRIC MOTOR AND BRAKE UNIT desire to grant licences under the patent to interested parties on reasonable terms for the purpose of exploiting the same and ensuring its full commercial development and practical working in this country. Enquiries to be addressed to: Cruikshank and Fairweather, 29 Southampton Buildings, Chancery Lane, London, W.C.2. (P 53)

FOR SALE

HUNDREDS OF MOTORS IN STOCK

1, 2, and 3-ph. and D.C. all sizes Geared Motors, M.G. Sets and special equipment made up. Rewinds and redesigns all sizes, 12 months' guarantee on all supplies and rewinds. Lists sent on request.

EDWARDS, WYATT & COURT LTD.
Grant Street, London, E.13. Grangewood 3697

A.C. and D.C. MOTORS, all sizes, large stocks. Fully guaranteed.—Milo Engineering Works Ltd., Milo Rd, East Dulwich, S.E.22 (Forest Hill 2278-9). (P 7)

A HIGH VACUUM IMPREGNATION UNIT or single or batch coil impregnation service to R.I.C. specification 214 or individual requirements.—Blickvac, Hamilton Rd Works, Hamilton Rd, S.E.27. Tel. Gypsy Hill 4394. (P 14)

A.A. ELECTRICAL CO. for A.C.-D.C. MOTORS, switchgear, exhaust fans, hoists, reduction gears, new or reconditioned units.—Chi. 5105, 67 Rothschild Rd, W.4. (P 8)

A.C. and D.C. MOTORS, GENERATORS from stock.—Service Electric Co., Ltd., Honeypot Lane, Stanmore, Middx. Edgware 5566-9. (P 9)

DON'T worry about your electricity bills. Fit 1s. slot electric meters for hotels, bed-sitters, etc. Prices from 50s.—Selectrics, Department E.T., Castle Circus Hse, Torquay. Tel. 7218. Trade inquiries invited. Trade discount. (P 15)

FLAMEPROOF MOTORS, M.G. SETS, D.C. MOTORS, GEARED MOTORS, A.C. MOTORS, TRANSFORMERS, CONTROL GEAR. SPECIALS. FLANGE MOTORS

ELECTROPOWER COMPANY LIMITED
Kingsbury Works, Kingsbury Rd, London, N.W.9
Tel.: COLindale 4621/3
Grams: Lectropowa, Hyde, London (P 12)

FOR SALE as it stands, 1 B.T.H. 300 kVA, 3-phase, 50 cycles, indoor type TRANSFORMER with off-load tapping switch H.V. end box and L.V. porcelains. Voltage 10,500/400. Transformer is on view at Transformer House, Greenlaw Rd, Yoker, Glasgow. Offers marked "Transformer" to be lodged with the Manager, P.O. Box 15, 206 St. Vincent St, Glasgow C.2, not later than 11 Dec., 1954. (P 67)

ELECTRIC MOTORS, D.C. and A.C., Motor Generator Sets, Alternators and Dynamos. Reconditioned and guaranteed, very large stocks held.

Britannia Manufacturing Co., Ltd., Britannia Walk, N.1. CLErkenwell 5512-3-4. Stores at Chobham, Surrey. (P 51)

HOUSE-SERVICE METERS, a.c. or d.c., quarterly or prepayment.—Universal Electrical, 221 City Rd, London, E.C.1. (P 10)

MERCURY SWITCHES are made by Hall, Drysdale and Co., Ltd., of 58 Commerce Rd, Wood Green, London, N.22. Tel.: BOW 7221. (P 11)

PURLEY CHOKES AND BALLASTS Our 80-W tapped h.p.f. ballast with starter switchgear-holder incorporated is proving itself the most popular unit. Suitable for most fittings, 57s. 6d. each subject.—F. W. Blanshard Ltd. (Dept. E.T.), Purley, Surrey. Uplands 4818-9. (P 13)

TIME SWITCHES from stock. Reconditioned or new. 12 months' guarantee. Lists from J. W. Hughes, 3 St. Thomas St, London Bridge, S.E.1. (Tel. Hop 2759.) (P 16)

TINNED STEEL ARMATURE BINDING WIRE. All sizes from 14 s.w.g. to 30 s.w.g. supplied in coil or on reels.—Frederick Smith and Co., Wire Manufacturers Ltd., Caledonia Works, Halifax. (P 39)

SWITCHGEAR. MV type K.O.B. metal-clad, single busbar, horizontal draw-out type switchgear, 3 phase, 50 cycles. Rated breaking capacity 100 MVA at 6·6 kV. 8 units for disposal in good serviceable condition. For full particulars apply—Box No. 4019, Electrical Times. (P 17)

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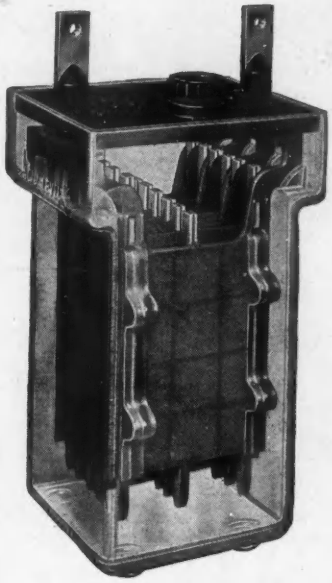

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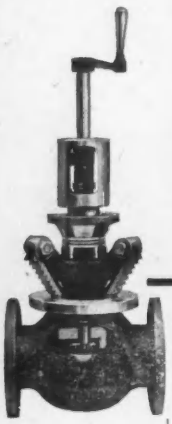

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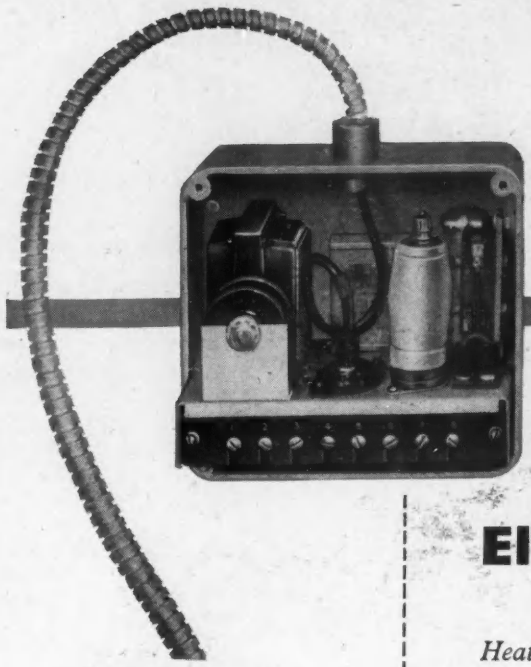

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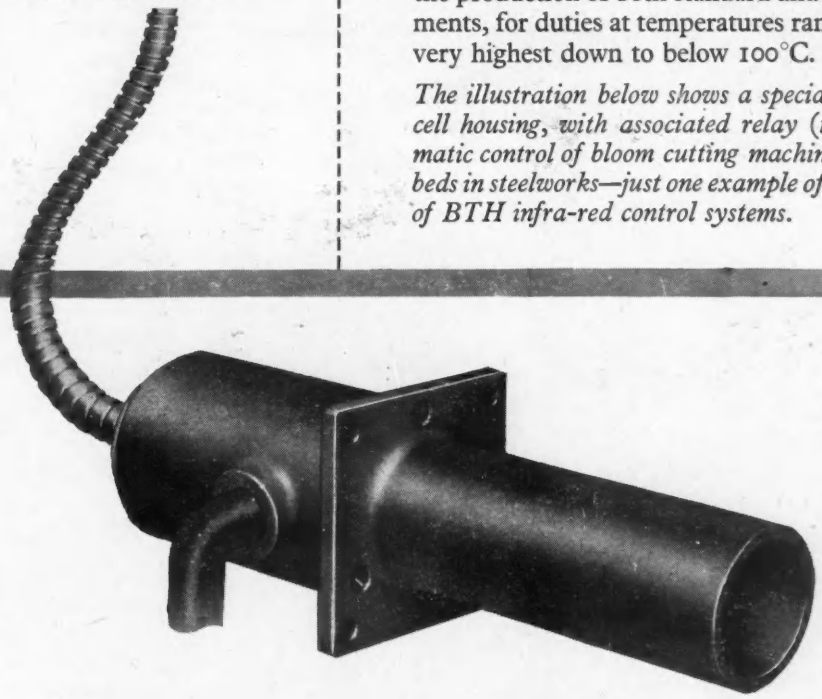

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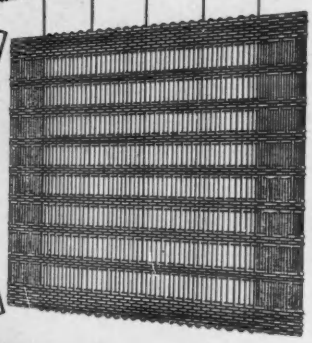

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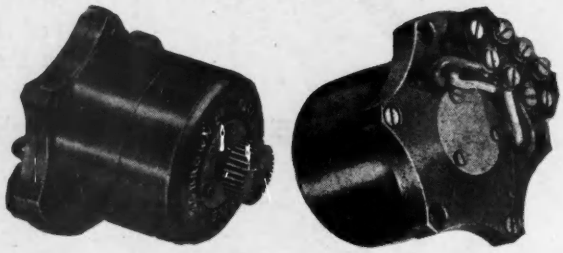

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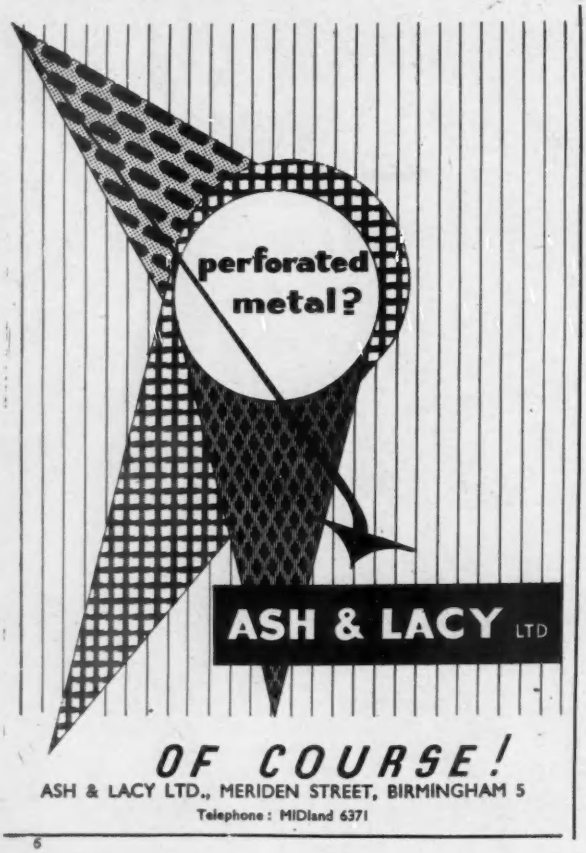

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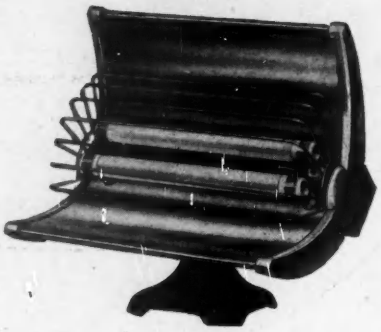

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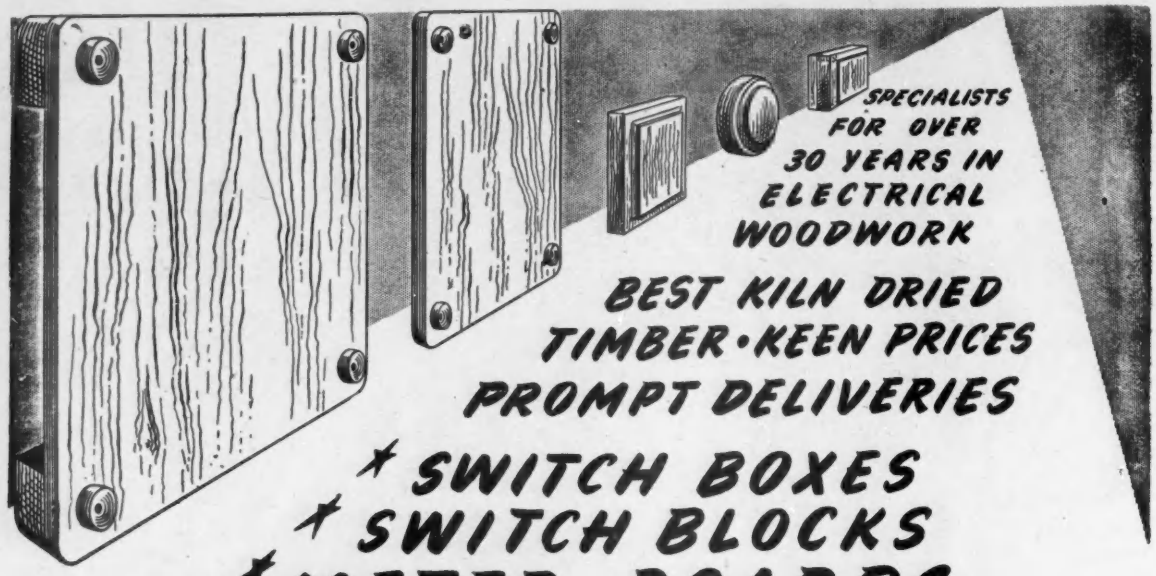

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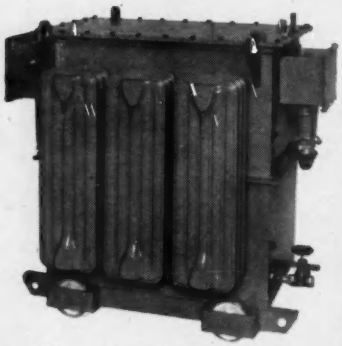

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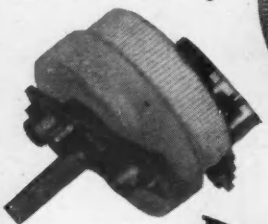

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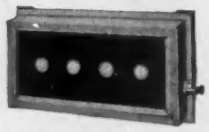

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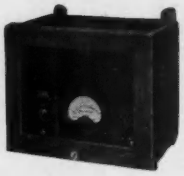

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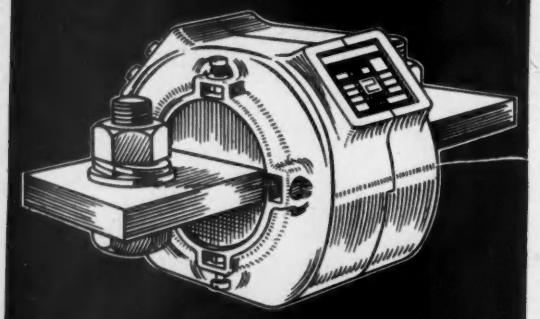

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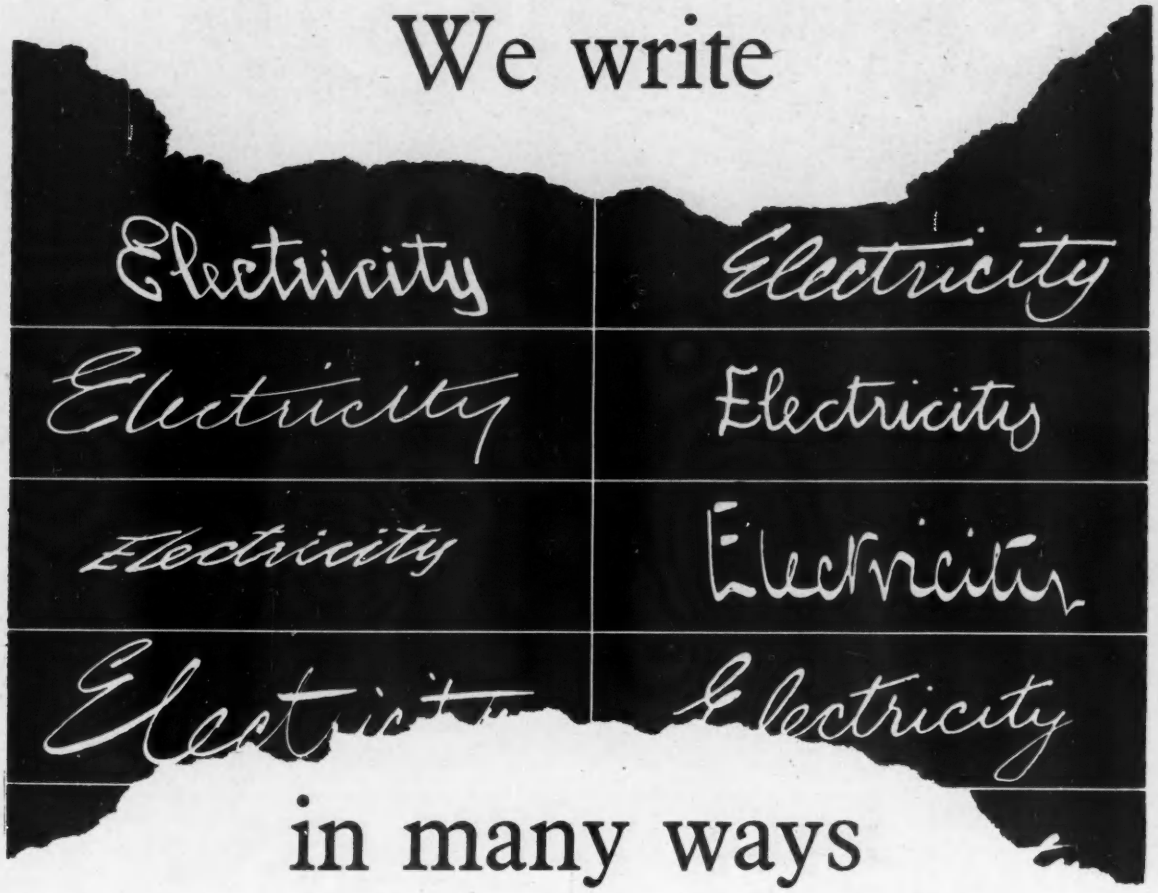

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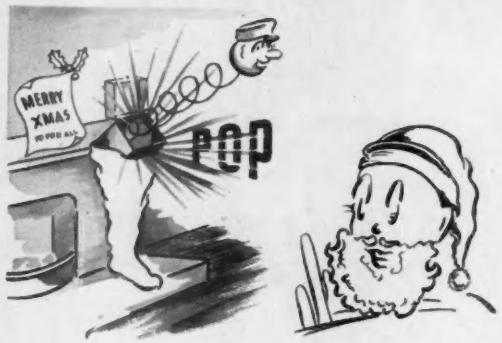

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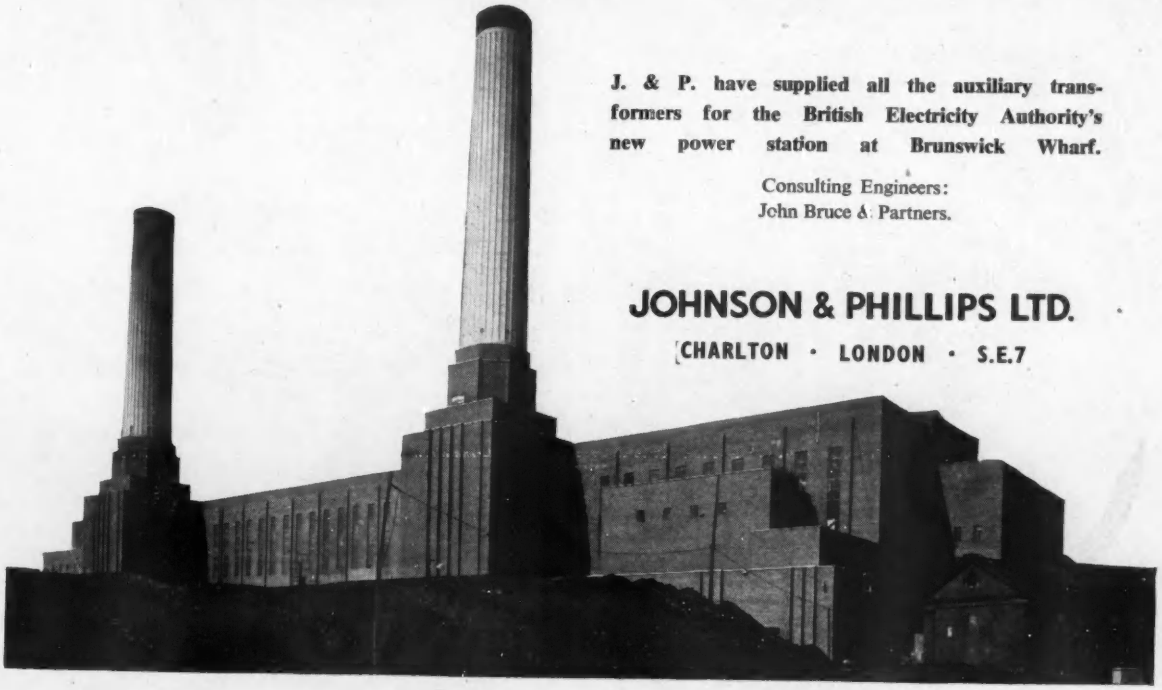

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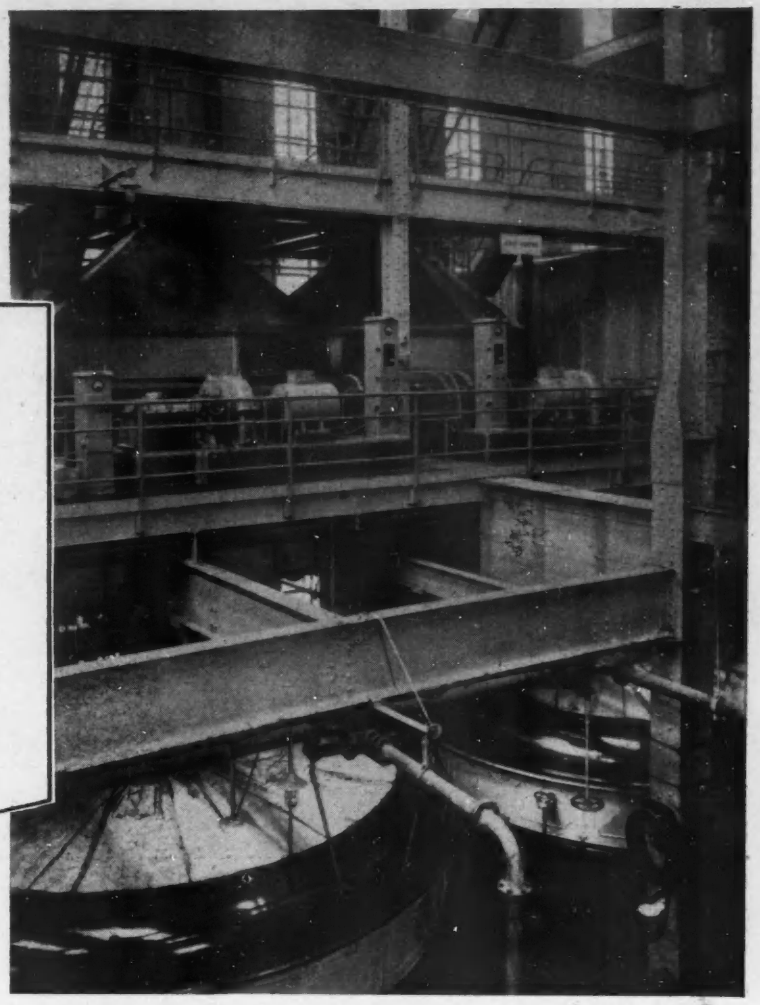

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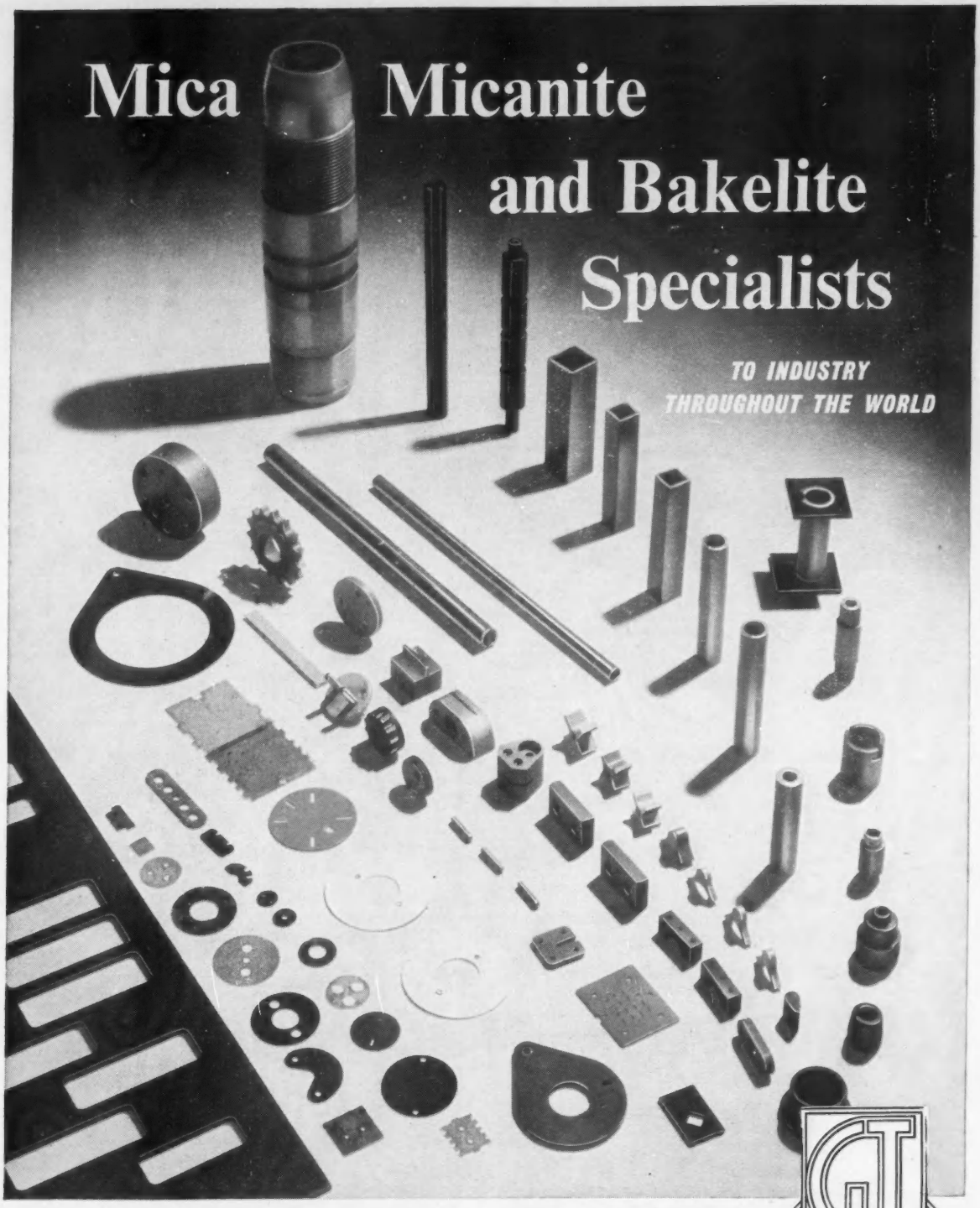

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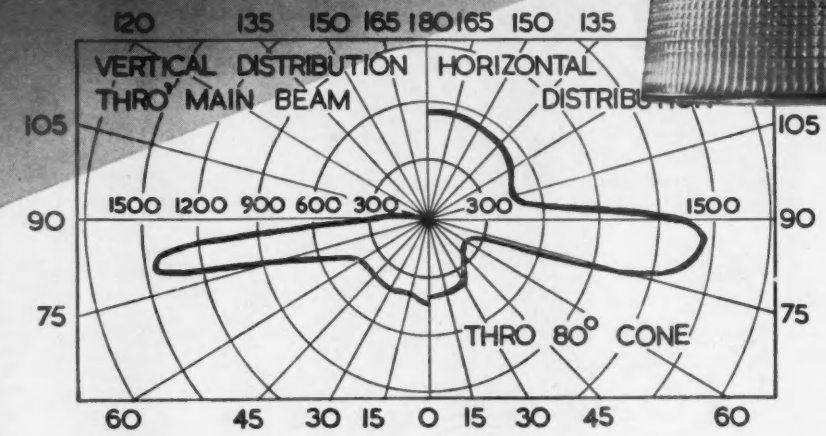

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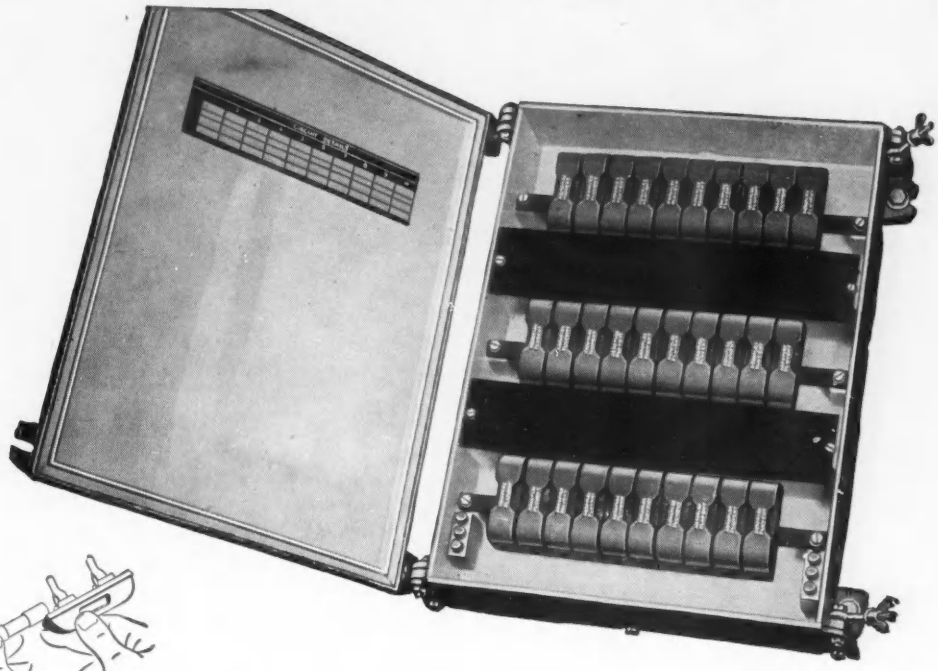

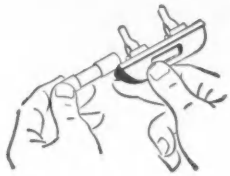

Type VB 15 AMP and Type VM 30 AMP for circuits up to 500 volts with Breaking Capacity 25,000 KVA to 440 AC4. Wiring is made simple by the removable end plates which facilitate drilling and the Aeroflex high breaking capacity rewirable cartridge fuses are carried in self-securing contacts. The busbars are secured to fuse contacts at ends resulting in clear wall space behind.

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